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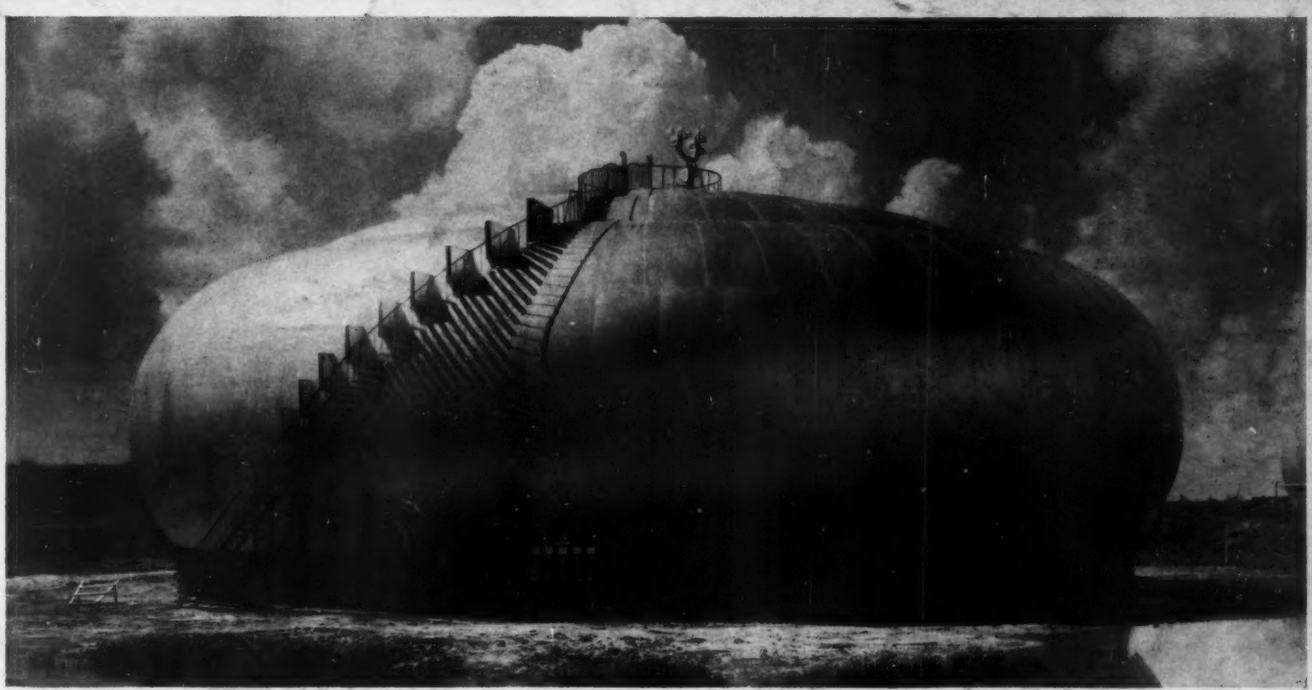

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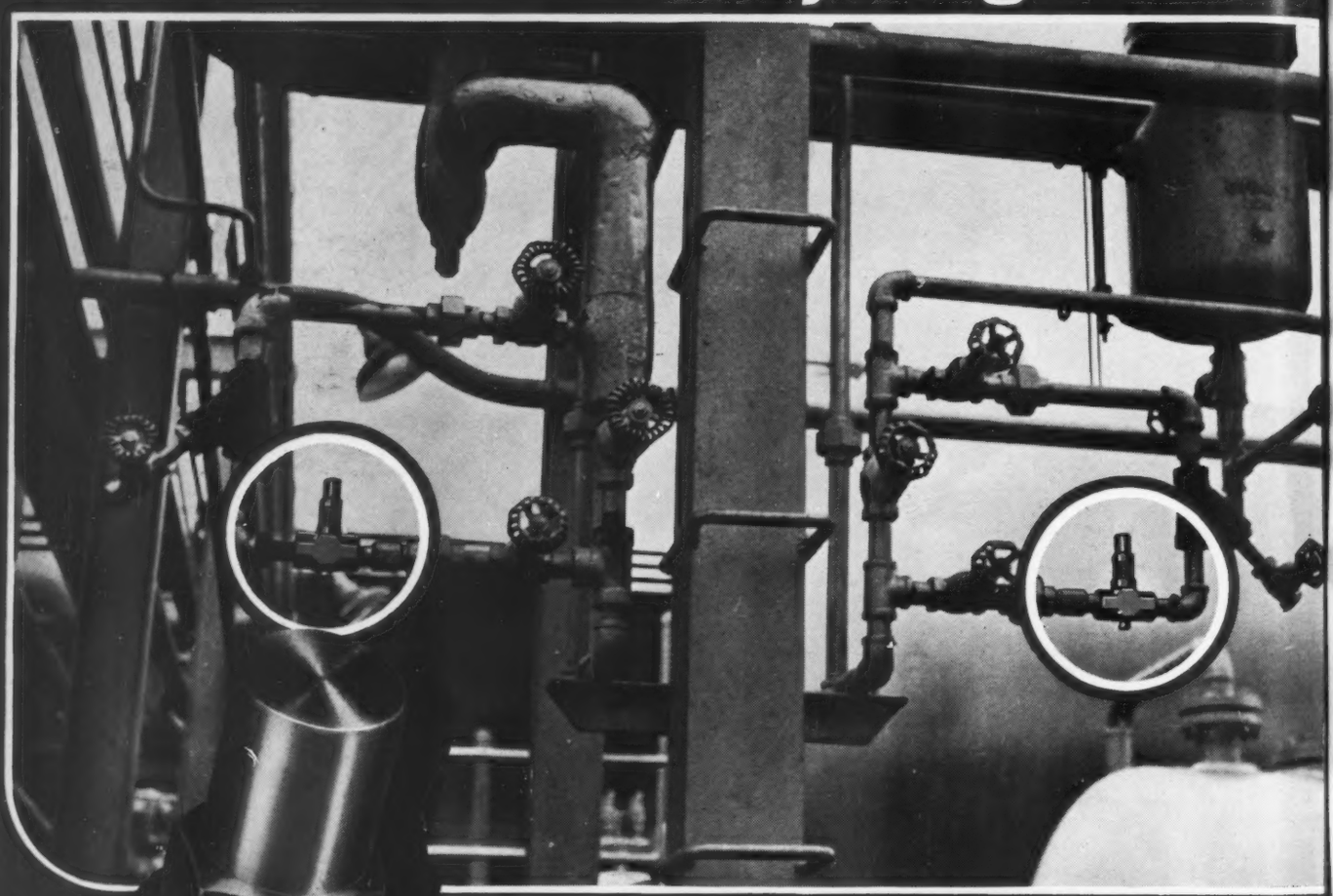

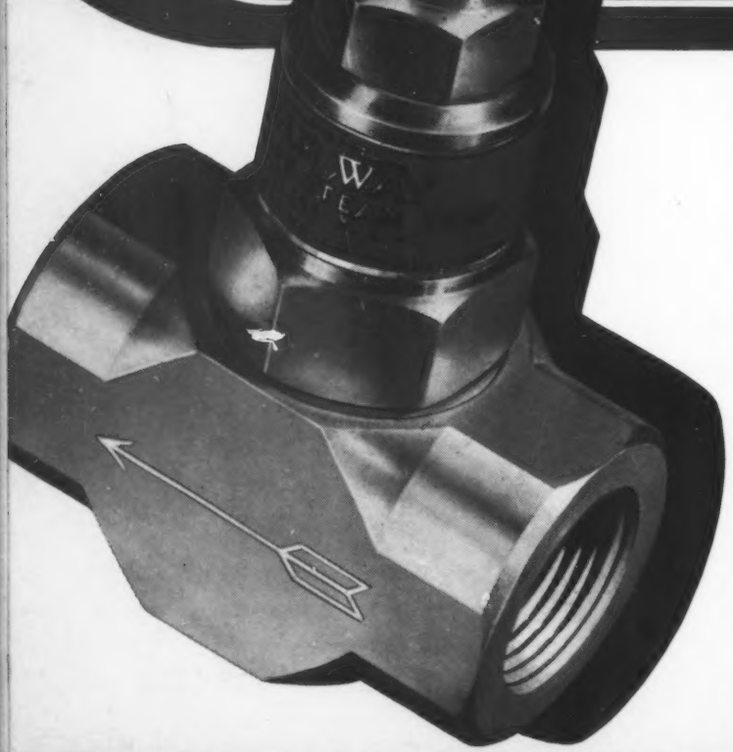

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PETROLEUM REFINER

SPECIALIZED FOR THE OIL REFINING INDUSTRY, INCLUDING PETRO-CHEMICAL ENGINEERING, PETROLEUM SYNTHETICS AND NATURAL GASOLINE

FEBRUARY, 1943
Vol. 22, No. 2

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GRADY TRIPLETT
Editor

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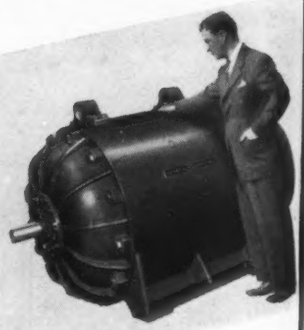

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GENERAL ELECTRIC

VOLUME 22, NO. 2 FEBRUARY, 1943

PETROLEUM
REFINER

SPECIALIZED FOR THE OIL REFINING INDUSTRY, INCLUDING PETRO-CHEMICAL ENGINEERING, PETROLEUM SYNTHETICS AND NATURAL GASOLINE

A GULF PUBLISHING COMPANY PUBLICATION

THE LOOK BOX

IN THE promise of manufacturing capacity of 435,000 tons of synthetic rubber per year by July, Donald M. Nelson, War Production Board Chairman, has given the first plant construction schedule to come from his department since the report of the Baruch Committee. Further he makes it clear that additional capacity will be added when this is complete.

Scaled Down

Evidently the controversy between civilian and military steel needs went to the White House, where Stabilization Director Byrnes determined that 55 percent of synthetic rubber capacity as previously recommended be accepted as currently imperative. He had to listen to Army and Navy officials as well as men from PAW, who are fretting over delay in completing added capacity for 100-octane aviation gasoline.

Of immediate concern is the status of civilian rubber prospects under this revised plant-building program. Experts who studied the problem for the Baruch Committee came to the conclusion that double the amount of capacity now recommended would be essential for military, lend-lease and civilian rubber needs. This million-ton program visioned keeping the automobiles of the nation operating.

Evidently the revision does not, except as more capacity can be added after plants are producing at the rate of 435,000, give civilian use of rubber serious consideration. Unless the demands for rubber have changed since this committee made its report, lack of rubber will within a few months curtail the use of gasoline at a ratio not even dreamed by those concerned with rationing.

In the absence of proper explanation, the observer is left to wonder if the attitude of the military toward rubber has prevailed. This attitude would assure sufficient rubber for prosecution of the war and give no consideration to civilian use. But drawing a distinction between military and civilian rubber needs is fully as difficult as drawing a distinction between essential and non-essential use of rubber in civilian activity.

If only the military is to have rubber, in time there will be a day when the worker in a steel mill or a shipyard is unable to arrive at work for lack of transportation. Under such conditions the tires on a civilian automobile become military rubber. However great the necessity for prosecuting the war, there is no escaping the fact that the economy of the United States has in the past quarter century been shaped by the automobile. When that is hampered the economy is restricted, which means that fewer guns will be made per thousand man-hours. Watching the tires deteriorate from the automobile is something more serious than keeping a family from going to a picture show.

All in all the rubber problem has been so poorly handled in Washington that it is little short of disgrace. As now revised, it is not what the American people expect. If it is all that can be provided with the steel available, it will be accepted.

But official Washington should this time make sure of its ground. Several stories have been told about rubber and each has been less optimistic than the one previous. Changes have been so frequent that the public doubts their soundness. Early last year, for instance, conversion of existing thermal-cracking equipment to butadiene

manufacture came to the forefront. By mid-year men in the government and in the petroleum industry were convinced that capacity for 200,000 tons per year could be operating by January 1, 1943.

But the conversion program was shoved aside until three months back, when projects calculated to produce 158,500 tons per year were authorized. Conversion of these plants could have proceeded from June rather than October and November. Evidently conversion of existing equipment fell into the spot where so many recommendations go in Washington. Neglect is the only explanation.

If conversion is a sound technical approach to butadiene in 1943 it was a sound approach in 1942.

Having A Look

AT LAST man can have a look at the molecule. This is the accomplishment of the electron microscope whose development to date permits visual examination of only a few of the larger hydrocarbons. Its promise, however, is that in time all these combinations of matter will come under scrutiny of the eye. The scientist then will have proof of much that has been accepted from calculation and deduction.

The possibilities of this microscope are beyond determination. One drawback in the development of chemical rubber has been that the scientist seemed convinced that nature had accomplished a combination of hydrocarbons than man could not duplicate. Given identical molecules the laboratory never seemed to get them assembled as nature did. Visual examination may solve that difficulty.

Having a look will help.

Fair Price

IN WORDS and statistics the oil producer can prove that he is doing business at a loss, therefore he asks that the price of crude oil be raised.

Already the refiner has submitted words and statistics to prove that he is doing business at a loss. An increase in the price of crude oil will further increase losses to the refiner.

If the two pleas are granted, buyers will have to pay more for finished merchandise. But through agencies the government is set on preventing price increases.

All anyone seems to want is a fair price. From the viewpoint of any buyer, a fair price is one no higher than now existing, preferably a lower price. From the viewpoint of a seller, a fair price certainly can not be lower than now existing, preferably it should be higher.

A fair price is a matter of viewpoint. When a government has authority to determine prices, the tendency is to follow its viewpoint, pleasing the most people for that is a means of staying in power.

It looks like a period of low prices for that is good politics with the backing of the disaster of inflation to bolster it. A fair price is one that comes out of free exchange of goods. That can not exist under war controls. It is something for the petroleum industry to talk about but it will not be attained so long as quotations are fixed by an agency instead of through dickering between traders.

Women At Work

AT FIRST management of refining concerns indicated that women could be moved to the yard offices as clerks and secretaries with satisfaction. Beyond that, however, the refinery looks like a man's field.

All of which is changing. Already the warehouse stock rooms are being staffed with women. Some are being trained for boiler-plant operation, where duties are not so strenuous as first consideration might indicate.

In time women will take over refinery work in an ever widening arc. If they can operate drill presses in other industries, they can handle similar equipment in a refining plant, something true of welding and pipe threading.

This places added responsibility on the personnel department. A refining plant involves hazards not common to ordinary mechanics. What it charges to the stills and what it completes in the towers are explosive products.

The safety engineer has a different approach for his activity. He must teach women how to work toward the goal of no accidents.

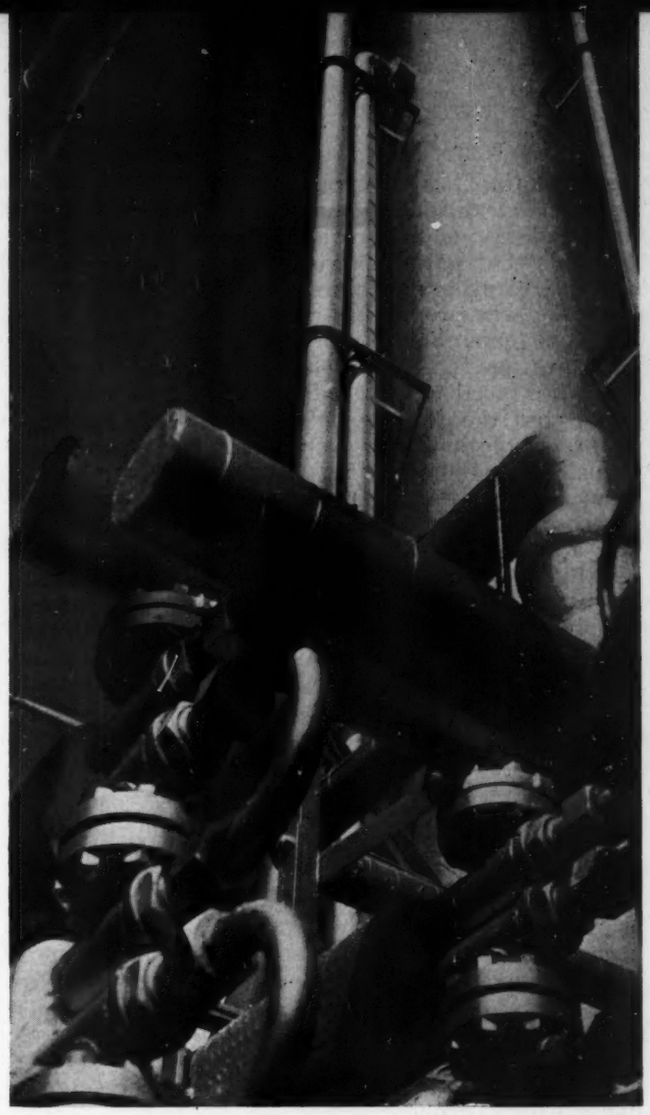
Another Gas Use

NATURAL gas is playing a role in providing the dehydrated foods which in greater volume are going to American armed forces abroad. A glimpse at this new trend in gas use was given by Arthur F. Bridge, vice president of Southern Counties Gas Company, Los Angeles, and president of the American Gas Association, as follows:

"It is evident that more and more emphasis will be placed on dehydrated food to supply our over-seas forces and lend-lease requirements. The clean, controllable qualities of gas are recognized by this expanding industry as highly desirable. During the important steps of storing and packaging dehydrated vegetables, fruits, and other foods, a development of the gas industry is being put to ever increasing use. This development, dehydrated air, protects the processed foods until they are permanently packed for shipment."

How to Break Piping Bottlenecks

G. W. HAUCK, Manager, Engineering Sales,
Crane Company



THE advent and continuous use of higher pressures and temperatures in power plants and manufacturing processes during the past decade or so, has been accompanied by a corresponding increase in the use of steel in piping materials. As a result, to serve these elevated operating conditions, steel initially, and of necessity, superseded the cast irons as a suitable metal in material specifications.

Almost concurrently, there was developed a gradual but definite preference for the use of steel instead of cast iron to take advantage of the greater strength of steel even in those services where the basic requirements of pressure or temperature did not suggest the use of the stronger metal.

In time, the increased production of steel progressively reduced its cost in those materials finding extensive use in piping systems. Ultimately, the differential in the costs of steel and cast iron became low enough to further accelerate the use of the better material of greater strength. This was particularly true of flanges.

The use of steel flanges, therefore, on the bulk of the lines comprising piping systems, has become accepted practice. The advantages of an unbreakable flange, of the same material as the pipe, appealed to users, because it eliminated failures due to the breakage of cast-iron flanges in transit, in handling, or, at times, in the severer operating services. This was particularly true in the larger sizes of flanged joints. Thus, steel flanges found their way into saturated steam lines, and all sorts of low-pressure services. Steel became the order of the day as the material for flanges used on most steel and wrought-iron piping. The age of steel found piping keeping pace.

At one time, lap joints were available with the flanges made of a variety of metals—cast iron, semi-steel or Ferrosteel, malleable iron, cast steel, and forged or rolled steel. For the past decade, however, the production of lap joints has been confined almost exclusively to the use of steel flanges in general practice. The cast irons and malleable iron were practically abandoned as suitable metals for the flanges.

When welding came into widespread use as a method of making pipe joints, it had a marked and an important influence in giving impetus to the swing from iron to steel flanges. Steel flanges are required in accepted practice when they are to be attached to steel or wrought-iron pipe by welding.

Developments in the refining and process industries found additional uses for steel flanges. They prove ideal for those pipe lines where fire hazard legislates against the use of cast iron. Certain services in these and similar industries also made the use of welded flanges desirable.

War Demand Creates Shortage of Steel

Thus we have traced and reviewed the principal factors responsible for the widespread use of steel flanges on much, if not, indeed, almost all of our

THIS article appeared in the November issue of "Valve World," published by Crane Company, under the title, "Some Hints on How to Break Bottlenecks in Piping Materials."

Its acceptance was such that engineers in several processing industries sought copies. Petroleum Refiner recognizes the recommendations as valuable in the urgency to complete plants despite shortage of steel.

Of George W. Hauck, Valve World gives this estimate:

"The author has had many years of practical experience in piping design, construction and maintenance and his conclusions are worthy of serious consideration."

piping work. This has created a "bottleneck" in steel flanges, a condition that has been apparent for some time, and seriously aggravated by unprecedented war demands that now make it acute because the steel required to make such flanges is desperately needed for other war production requirements. We just do not have enough steel for everything, and flanges do not escape the critical shortages. This means that users are faced with the dilemma of finding a way to by-pass the shortage of steel flanges. The only apparent solution is to suspend the general practice of using steel flanges for all services. Instead, we must revert to our former habits of using steel only where service conditions make its use mandatory. For all other services, cast-iron flanges, which are usually available, make an acceptable alternate. A consistent effort by all users to spread the available supply of steel flanges over a wider area of essential needs only, and using the alternate cast-iron flanges in every possible service, will contribute materially to the war effort during the emergency when steel must be conserved.

Advantages of Cast Iron

From the foregoing, it is apparent that a recommendation outlining the services where cast-iron flanges are satisfactory is in order. Cast-iron screwed flanges and cast-iron lap-joint (Van Stone) flanges are available for operating conditions which do not exceed 250 psi saturated steam pressure and in most cases where the service does not exceed 450° F. maximum.

Cast-iron screwed flanges are available in a range of sizes from 1-inch to 24-inch, inclusive, in the 125-pound and 250-pound pressure classes. The screwed flanged joint, properly made, has proved its general utility and satisfactory performance within its pressure and temperature limitations. If prefabricated piping is purchased, an added advantage can be gained by specifying the refacing of screwed flanged joints. In this process, the flange is made up tight until the end of the pipe projects slightly beyond the face of the flange. A light refacing cut is then taken across the face of the flange and the end of the pipe. This provides an excellent gasket-bearing surface to the inside of the pipe because the end of the pipe is flush with the face of the flange. Refacing also produces perfect alignment of the flange face at 90 degrees with the center line of the pipe, and makes for easy bolting without stresses.

Lap Joints

Again, lap joints (Van Stone) are generally available with cast-iron flanges in a range of sizes from 2-inch to 24-inch, inclusive, in both the 125-pound and the 250-pounds pressure classes. In addition to the regular cast iron conforming to ASTM Specification A-126 for Class A Castings, lap-joint flanges are also obtainable made of higher strength cast iron conforming to ASTM Specification A-126 for Class B Castings. This latter cast iron is also known as semi-steel, or Ferrosteel. It is Crane practice to furnish cast-iron lap-joint flanges made of Ferrosteel only, as good engineering practice recommends the use of the stronger of these available cast irons.

Cautionary Suggestions

Thus, the use of cast iron instead of steel makes available the lap joint for many services where this type of joint with its advantages is preferred. But an important cautionary note is necessary. Care must be exercised in bolting up any lap joint equipped with a cast-iron flange in order to prevent breakage. Pipe fitters are accustomed to finding all lap joints with steel flanges, and they cannot apply extremely heavy bolt loads or sledge bolts when cast-iron flanges are employed.

Several additional cautions are suggested:

1. Cast-iron flanges should never be used on the ends of any type of expansion pipe bend. Such flanges, as well as those on the piping adjacent to the expansion pipe bends, should always be of steel to preclude breakage.
2. Cast-iron flanges are not recommended for lines handling hazardous fluids, or where fire hazard legislates against their use.
3. Do not exceed code limitations concerning pressure and temperature in using cast-iron flanges.

Other Materials Are Affected

A consideration of bottlenecks in piping materials and suggestions for alternates or substitutions cannot be confined to flanges alone. Many other items comprising piping systems are affected by the shortages and limitation orders that are current today and which plague designers, manufacturers, purchasers, and erection or maintenance crews. The list of alternates or substitutions contained in the following paragraphs is not intended to be all-inclusive, but simply to focus attention on the necessity for a realistic attitude in thinking about the standards of installations and materials for the various components of any piping system. Shortages of materials and long deliveries on many items commonly used should throw into bold relief the need for flexibility in specifying requirements, attended at all times by a willingness to quickly revise plans to accept alternates or substitute materials which may be available at the time and which will do the job with sufficient satisfaction to justify the change.

To adhere strictly to hard and fast specifications and to ignore the exigencies of the day is to invite costly delays and often an unnecessary expense in expediting articles not in stock or difficult to obtain while satisfactory substitutes rest in the stock bin, or at worst could be produced in a shorter time.

Unions

Just as the age of steel found flanges keeping pace, so it is with unions. A few years ago the advent of relatively low-priced steel unions persuaded many users to adopt them in preference to malleable iron unions. As in the case of flanges, there ensued a marked preference for the use of unions made of steel instead of iron to take advantage of the greater strength of steel even in those services where the basic requirements of pressure and temperature did not suggest the use of the stronger metal. The advantages of a union made of an unbreakable material and of the same material as the pipe appealed to users.

Because steel is needed for other war production requirements, there are shortages of steel unions and often they are not available when needed, even on the most important piping projects. In many instances, the shortages can be side-stepped by reverting to the former practice of using malleable-iron unions whenever the service conditions permit their use. Specify steel unions only when the pressure or temperature conditions require them or if the nature

of the liquid or gas in the pipe line would preclude the use of any union other than one of steel.

Union Fittings

While on the subject of unions, it is well to call attention to union fittings. It is known that union fittings have never been utilized to anything like their fullest possibilities. Aside from their normal features of a saving in the number of joints and labor, better appearance, etc., they have an added advantage today in that they may be available at times when unions, nipples, or fittings may not be in stock.

Flange Unions

It is accepted practice with many to confine the use of flange unions to sizes 2½-inch and larger, overlooking the fact that they are made in the smaller sizes in both cast iron and malleable iron and in several pressure classes. Flange unions are made as small as ½-inch in some patterns. Remembering this might save a delay because small flanged unions may be available when a nut union in either malleable iron or steel is not readily obtainable.

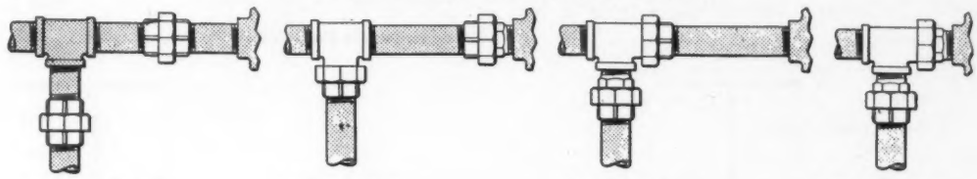
Small Fittings

Again, just as in the case of flanges and unions, and for the same reasons, small fittings of steel superseded those made of cast iron or malleable iron in parts of piping systems. Again, shortages of steel fittings can be by-passed by reverting to former practices. Conserve steel by using more cast-iron and malleable-iron screwed fittings—they are made in several pressure classes and provide satisfactory service for many lines, with the added advantage, at present, of being more readily available than steel fittings.

Small sizes of forged steel fittings are made today with screwed ends or socket-welding ends. For certain services, users found it desirable formerly to seal-weld the joint made by screwing pipe into a threaded steel fitting. This was partly, if not largely, responsible for the development of the steel fitting with socket-welding ends, which has advantages over the screwed fitting when the joint between the fitting and the pipe is to be welded. Thus, we normally find two types of small steel fittings— screwed end for the threaded joints, and socket-welding end for the welded joints.

But when shortages of steel preclude maintenance of consistent stocks in both types, a construction program might be accelerated by the acceptance of either type or a combination of both types in the assorted sizes and variety of fittings needed in a job.

TEE CONNECTIONS WITH UNION JOINTS



5 Pieces of Pipe
3 Fittings
8 Pipe Threads
10 Joints Assembled

3 Pieces of Pipe
2 Fittings
4 Pipe Threads
7 Joints Assembled

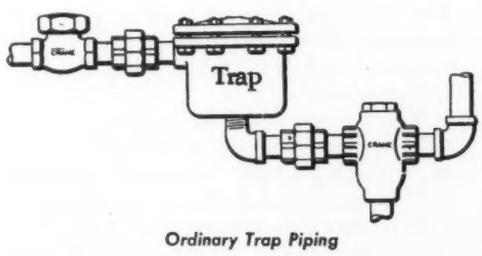
3 Pieces of Pipe
2 Fittings
4 Pipe Threads
7 Joints Assembled

2 Pieces of Pipe
2 Fittings
2 Pipe Threads
6 Joints Assembled

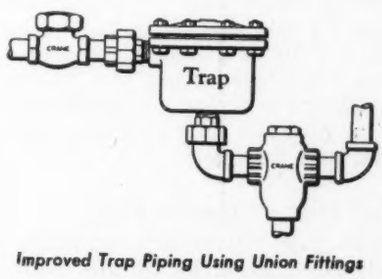
Even though the socket-welding fitting is better than the screwed fitting with a seal-weld, the latter is merely a reversion to a practice formerly followed satisfactorily. Conversely, a job may normally require screwed steel fittings and, if they are not available when needed, the substitution of socket-welding fittings, if obtainable, is the answer to that dilemma. And, a mixture of both types of fittings in the same line, while not 100 percent mechanically correct or perhaps in tune with a standard in a plant, might solve a vexing and costly delay in construction.

Small Steel Valves

The suggestions in the preceding paragraph apply with equal force to small steel valves which are made with socket-welding or with screwed ends. A willingness to use either type of end connection, or an assortment of both, may pay dividends in time saved.



Ordinary Trap Piping



Improved Trap Piping Using Union Fittings

In some cases it may be the practice to use small steel valves with flanged ends. If, some day you find that flanged valves, or the flanges, or the studs, or the desired gaskets (it takes all of these to make this flanged installation) are not available when needed, check to learn if a socket-welding-end or a screwed-end valve can be used.

Angle Valves

Globe valves are used to a much greater extent than angle valves. The demand for valves today means that the stock bins for globe valves may be empty while the bins for the corresponding angle valves may contain the answer to that immediate need. Globe valves are used in straight lines of pipe,

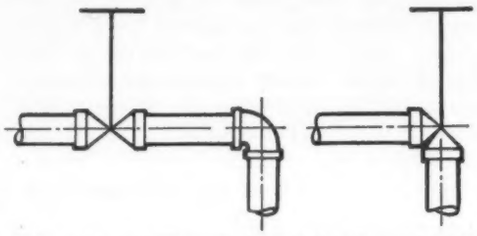
but almost all piping contains "turns." Often a "turn" is not far from the place where the globe valve is to be installed. An angle valve could be used here to take the place of the globe valve and the "turn," and eliminate one joint. In very few instances can fault be found with such a substitution.

By-Passes on Valves

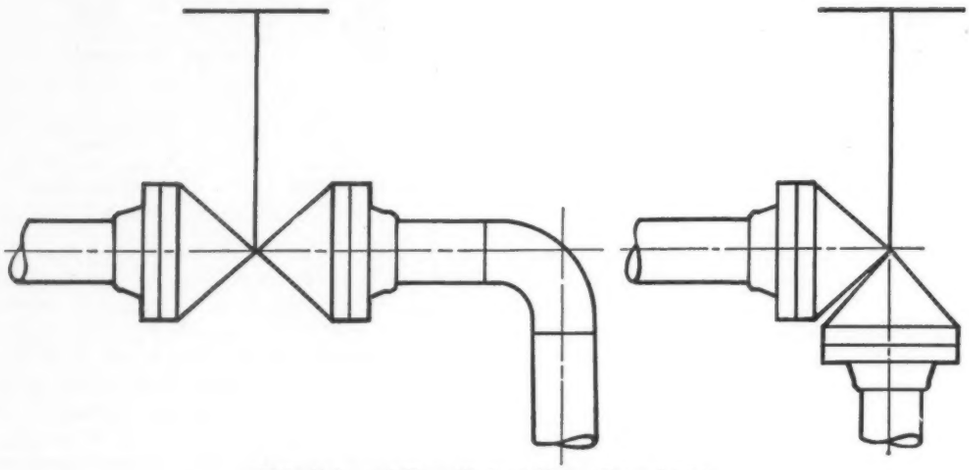
A by-pass is a "must" for many valves. While valves with by-passes are listed in a wide variety of sizes and pressure classes, the predominant demand and the resultant production is for regular valves without by-passes. To attach the by-pass, which involves extra labor operations, may delay procurement of a valve with a factory-built by-pass. While suffering from this delay, a regular valve often may be obtained in much less time. Possibly the installation is such that the by-pass can be constructed independently of the valve and around it by providing connections in the adjacent pipe or fittings and constructing the by-passes on the job.

Caution: When constructing by-passes around valves, be sure to provide flexibility in the by-pass piping to compensate for expansion stresses.

If the materials for constructing the by-pass are not at hand, it might be practical to install the valve and "limp along" until such time as the by-pass materials are secured and installed.



Globe Valve and Elbow VS Angle Valve, Screwed Joints



Globe Valve and Elbow VS Angle Valve, Flanged Joints

Wedge Disc or Double Disc?

A few classes of gate valves are regularly listed in both the wedge-disc and the double-disc types. Users have developed preferences for each over the other, but in many instances one type can be substituted for the other without detracting from the effectiveness of the installation.

Steel Stem or Brass Stem?

Just as in the construction of discs, so it is with steel stems or brass stems in iron-body gate valves—users express their preferences for one or the other in writing requisitions or specifications. For this reason, in normal times, we find stocks of these valves practically duplicated, the only difference being in the material ued for making the stems.

But these are abnormal times which militate against either a consistent production or maintenance of stocks in what practically amounts to a duplication. And, scarce materials must be conserved, which means that brass stems may not be as plentiful as steel stems. It is suggested that preferences in stem materials be discarded. It is only in isolated cases that valves with either steel or brass stems will not suffice for a satisfactory installation.

Valve Stem Packings

All valves are regularly equipped in the factory with valve-stem packings that are suitable for general service in keeping with the pressure, temperature, and operating conditions for which various valves are rated. It follows that valve-stem packings are individually and carefully selected to provide a standard of satisfactory service. Valves are only carried in stock with the valve-stem packings adopted as standards.

When every effort is being devoted toward the manufacture of valves in the greatest volume which is possible to meet abnormal demands, it is apparent that an order for valves to be equipped with a packing other than that regularly provided would mean a break in production. Costly delays ensue for both the manufacturer and the user. It is far better to discard any predilection for a specific packing when such a choice interferes with normal procedures and the possible slight advantage can only be gained at the price of delay in procurement. Even when a special packing must be used for unusual service conditions, it is suggested that regular valves be obtained and the procurement and installation of the desired packing accomplished by the user subsequently.

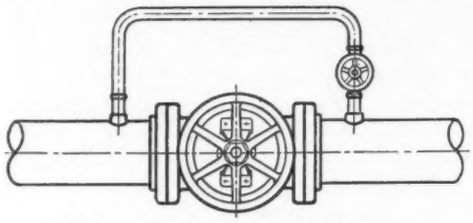
Special Valve Operators

Special valve-operating devices, such as floor stands, hydraulic cylinders, gears, air motors, electric motors, etc., normally are ideal from a mechanical or operating standpoint for specific installations. Under current conditions, however, specifying a regular

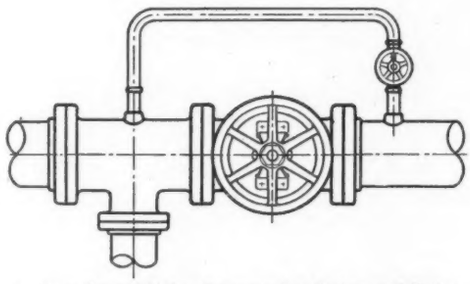
hand-operated valve will speed up deliveries and the completion of projects. Use the special operators only when absolutely essential and when no substitution is practical. Perhaps the installation is such that hand operation will suffice until the special operator wanted is more readily obtainable at a later date.

Screwed, Flanged, or Welded Joint?

Embracing all items of valves, fittings, fabricated piping, etc., the type of end connection or joint must



By-Pass Around Valve Connected to Piping



By-Pass Around Valve Connected to Piping and Fitting

be kept in the foreground of the thinking of those who are alert to break construction bottlenecks. For instance, if shortages involve flanged connections, perhaps a screwed or a welded connection is the answer to the problem. Perhaps a flanged valve or fitting is available, but the flanges or the studs are not. Can a welding-end valve or fitting be used? It just might mean the saving of valuable time. Such thinking and flexibility in making substitutions may prove helpful many times.

It is not uncommon to find many plants which have a standard of piping construction that calls for two or more types of joints in the various sizes of pipe lines in the same service. As an example, on certain lines, screwed joints are used in sizes 2½-inch and smaller and flanged joints in sizes 3-inch and larger. The next project may disclose that some of these 3-inch or 4-inch, or 6-inch flanged fittings, or the flanges, may not be in stock at the moment. The substitution of screwed fittings is worthy of consideration. Or, perchance, a welding fitting could be used satisfactorily. Or, a fabricated pipe bend or assembly might circumvent delay.

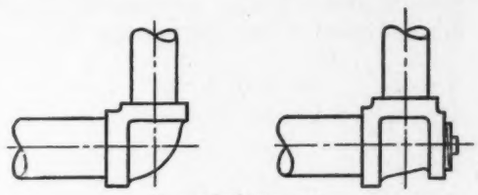
Fabricated Piping

That flanged elbow with a special dimension on one end, or that flanged tee with an elongated dimension or the run, or that special base elbow can be difficult if not impossible of procurement because it involves pattern work, special machining and handling, etc. Inquiry may disclose that this problem can be solved by the shop fabrication of a piping assembly. Special tees can be made by welding the outlets in pipe and providing flanged ends, threaded ends, or ends beveled for welding. Bases can be applied by welding.

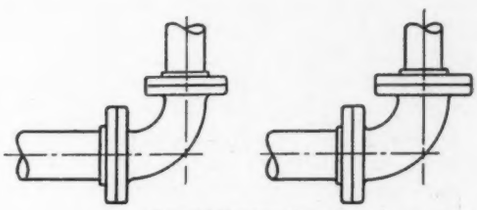
Pipe bends can be used for turns, offsets, and for accomplishing all sorts of changes in direction. The variety of shapes into which pipe can be bent suggests interesting possibilities.

The same holds true for welded headers with multiple nozzle openings, drip pockets, tapped bosses, etc., or for welded assemblies. Reductions in sizes can be accomplished by swedging, and end closures can be fabricated by welding. And so it goes.

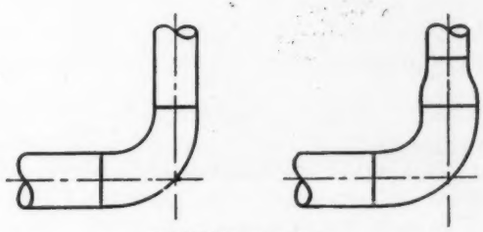
The most unlimited range of possibilities created



Screwed Construction



Flanged Construction



Welded Construction

by the use of prefabricated piping should occupy a prominent place in the minds of those who are intent upon overcoming delay and breaking bottlenecks.

Special Facings

Flanged piping materials are listed with special facings, principally in male, female, tongue, groove, and ring joint, with some additional special types and adaptations. The facing of flanged material as regularly produced and carried in stock is confined, in general commercial practice, to plain face with smooth finish for low pressure and standard cast iron: 1/16-inch raised face with serrated finish for extra heavy cast iron and 150-pound and 300-pound steel; ¼-inch raised face (large male) with serrated finish for steel in 400-pound and higher pressure classes.

Here is another opportunity to be realistic—in place of the special facings, the regular commercial facings generally can be used satisfactorily. There are instances, many of them border line cases, when normal preferences for special facings may be justified. Under present conditions, however, it is advisable to dispense with special facings in favor of regular whenever it is possible.

Bolting Materials

Having previously described the trend toward an increased use of steel in other products, it is well to direct attention to a concurrent trend toward the application of alloy bolting materials in flanged

joints when the actual operating conditions did not necessarily require this class of product.

Commercial steel bolts or studs are recommended for temperatures up to 500° F. Alloy studs are needed when temperatures are above 500° F. The prevalent scarcities of alloy steels dictate the installation of commercial steel bolting material whenever it can be used. Enough installations of 150-pound and, to some extent, of 300-pound steel materials are for services which permit the use of commercial bolting to justify the inclusion of this suggestion.

If You Weld

The plant which has adopted welding as the exclusive tool for making piping joints may be experiencing difficulties because some type of welding flange is not available for making flanged connections to valves or other equipment. Perhaps the substitution of screwed flanges is impossible because equipment for threading the pipe is not available.

If a cast-iron flange can be used, as outlined in the first part of this article, then a flanged connection can be provided for attachment by welding.

The welding elbow needed may not be readily available, as may happen in the case of those made with a wall thickness or of a material not regularly carried in stock. A beveled end pipe bend made from pipe of the desired thickness or material sometimes can be fabricated and save time. The pipe bend would have longer center-to-end dimensions, but many times that presents no particular problem.

Black or Galvanized?

This suggestion applies particularly to the smaller sizes of fittings, unions, nipples, etc., which normally are carried in stock in both black and galvanized finish. The lack of a few pieces in black often can be supplied from galvanized stock, and the reverse is equally possible. This substitution has proved its utility many times in past months.

A few simple substitutions are listed herein to illustrate how a lttle ingenuity can solve many everyday problems of shortages.

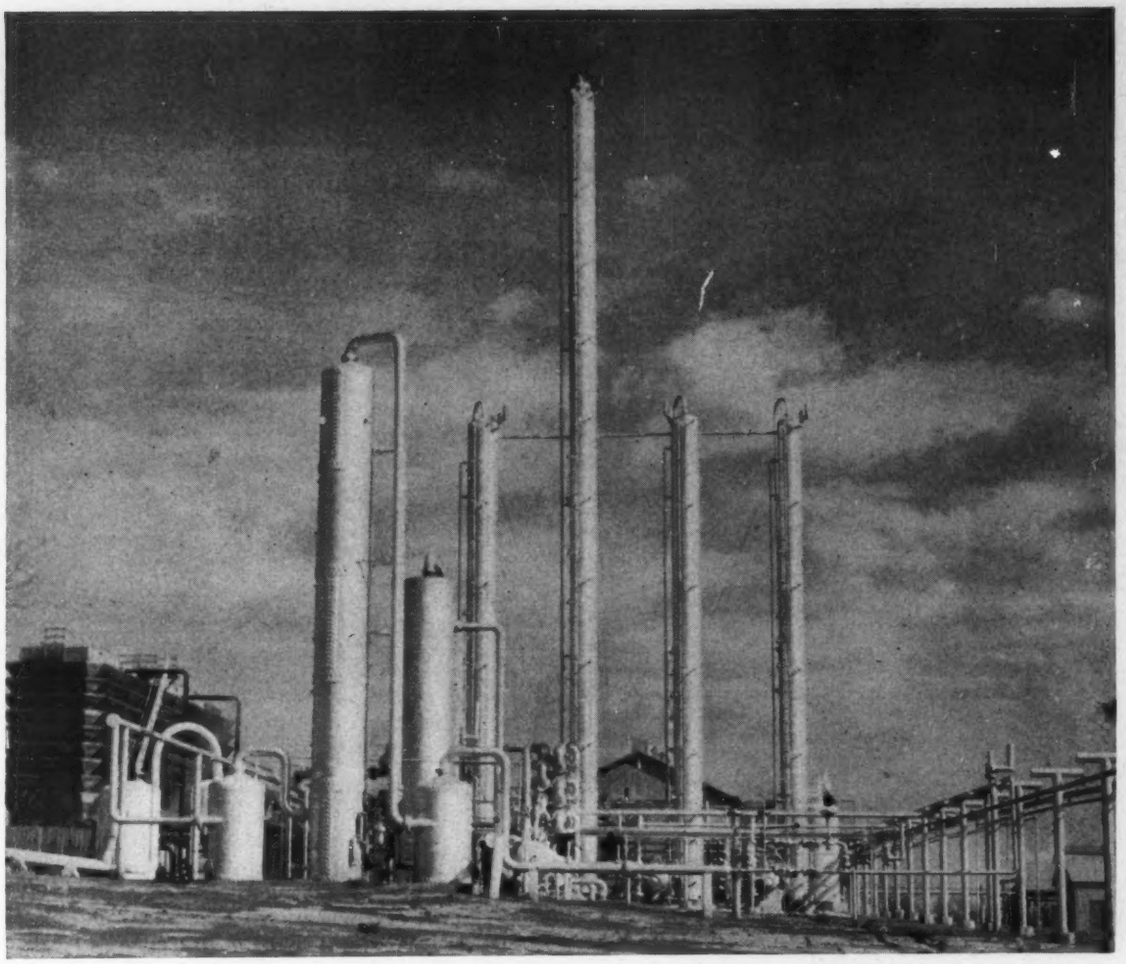
A reducing screwed flange often can be made by tapping a blind flange, either concentric or eccentric as desired. This is practical, provided the tapped opening is not too large in pipe size to preclude a sufficient length of thread for a satisfactory pipe joint.

A piece of plate, if available, can be fashioned into a slip-on welding flange or a lap joint flange if the thickness is increased, particularly in the latter, to compensate for the lack of hub. Similarly, a blind flange can be fabricated from steel plate. These are not recommended necessarily as good practice, but they are satisfactory in certain instances, especially in emergencies.

Instead of a 4 x 3-inch screwed elbow required for an extension of a pipe line during a shutdown, perhaps a 4 x 3 x 3-inch screwed tee with a 3-inch plug would answer the purpose. If this happened to be a flanged job and the reducing fitting were not in stock, would a straight fitting and a reducing flange suffice? If it were a welded job and the reducing fitting unavailable, would a straight fitting and a reducer satisfy the need? Generally, the answer will be in the affirmative.

Today the bushing comes into its own as never before. Many sizes of reducing screwed fittings have been eliminated due to the simplification program. At other times, the desired reducing fitting may not be available. Use the nearest size of reducing fitting or a straight fitting with bushings to break these bottlenecks.

It is well to repeat that the list of substitutions suggested herein is not all-inclusive, nor is it intended to hold any brief for some of the constructions suggested in the substitutes. They do not always portray the most desirable practice from a mechanical or a standardization viewpoint. But, shortages and the necessity for maintaining speed by circumventing the attendant delays require users of piping materials to be opportunists and extremely flexible in their thinking at all times. Only in this way may you be able to salvage a bit of leisure time and save embarrassing explanations for delays.



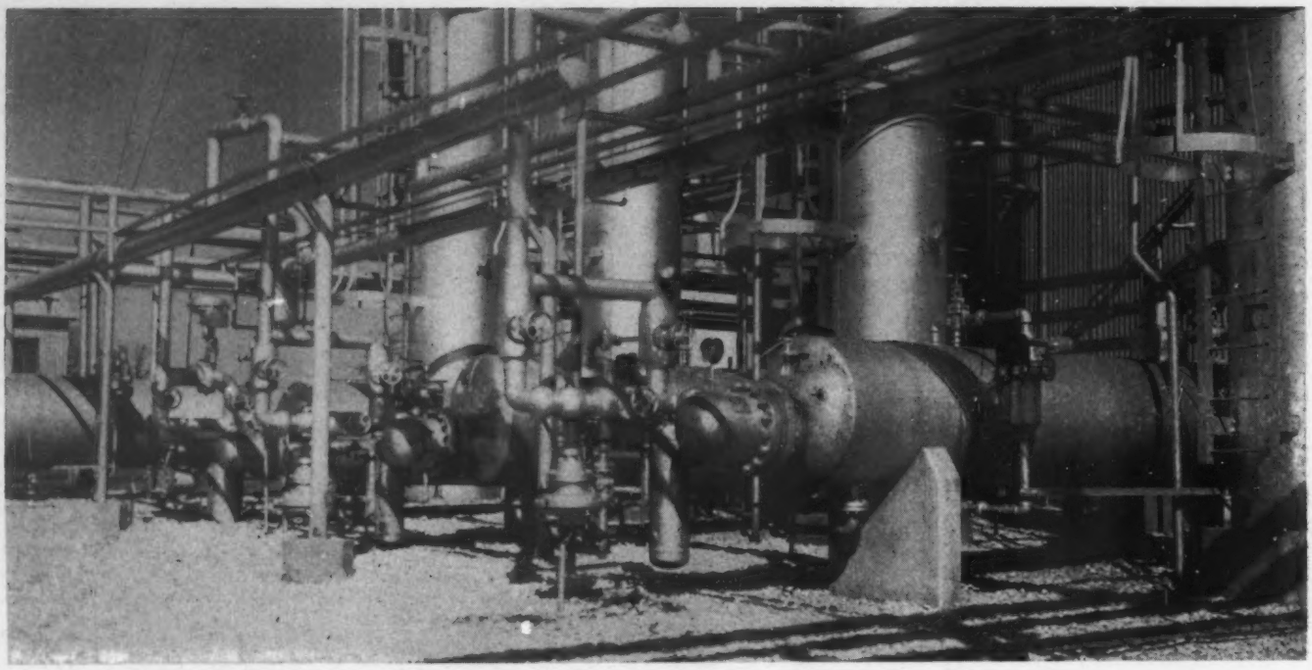
Compression Combined With Close Fractionation

IN THE new plant of Warren Petroleum Corporation in the Cumberland field, Marshall County, Oklahoma, a variety of natural gasolines and liquefied-petroleum products is being finished under controlled fractionation. This plant draws raw materials from an old field which is slated to be submerged with the completion of a flood-control and hydro-electric project along the Washita and Red rivers.

Oil and gas are produced in the conventional manner. The gas is gathered from the separators and traps and flows to the gasoline plant through a single large transmission line with only enough pressure held back by the regulators to dump the oil from the separators into the lease flow tanks. The pressure on the plant field scrubber inside the yard averages approximately 2 inches of vacuum, but varying up or down from that pressure, depending upon how well the flowing schedule is adhered to by the producers.

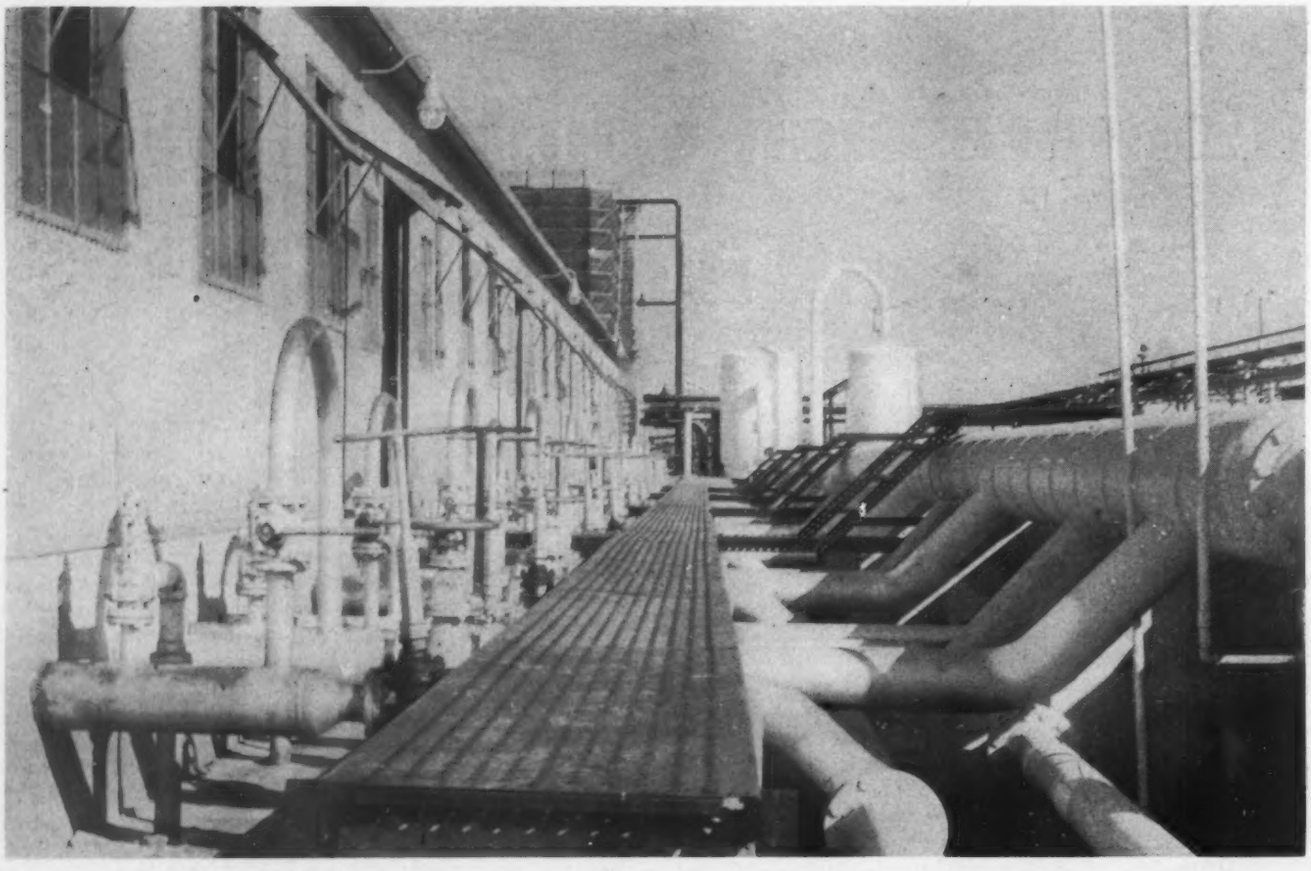
The plant was built from a combination of used and new equipment; the old equipment including the compressor units, and the single high-pressure absorber which was removed from an idle plant formerly operated in the South Oklahoma City field. The equipment made especially for the Cumberland field plant includes the distillation unit, the four fractionators which are operated in series, and the pumps, reflux tanks and the commodity receivers. The plant is designed to operate as a combination compression and absorption project, operating at 300 pounds in the final stage of compression. This pressure is maintained so that a substantial percentage of the gasoline fractions can be obtained by the compression method and so that the residue, above field and plant fuel requirements, can be introduced into a transmission system.

Ten horizontal, 200-horsepower gas engines were



Reboiler section of the fractionating system for close cuts of natural gasoline and liquefied petroleum gas cuts.

installed in the engine room, set on the concrete blocks, when the plant was being constructed, but later supplemented with two eight-cylinder angle-type machines, all of which are used to process the field gas as well as recycle vapors from the rich-oil vent tank and vapors recovered from accumulators and various commodity receivers. The field gas is taken from the single plant field scrubber at the east end of the engine building and compressed in the first stage to 40 psi and cooled in atmospheric units placed in the louvre tower. Both the gas and liquid condensate are passed into an accumulator for the separation of gasoline and water, if any, with the gas flowing directly to the high-pressure intake header.



By designing the intake header with ox-bow loops, welded construction permitted dispensing with customary use of fittings.

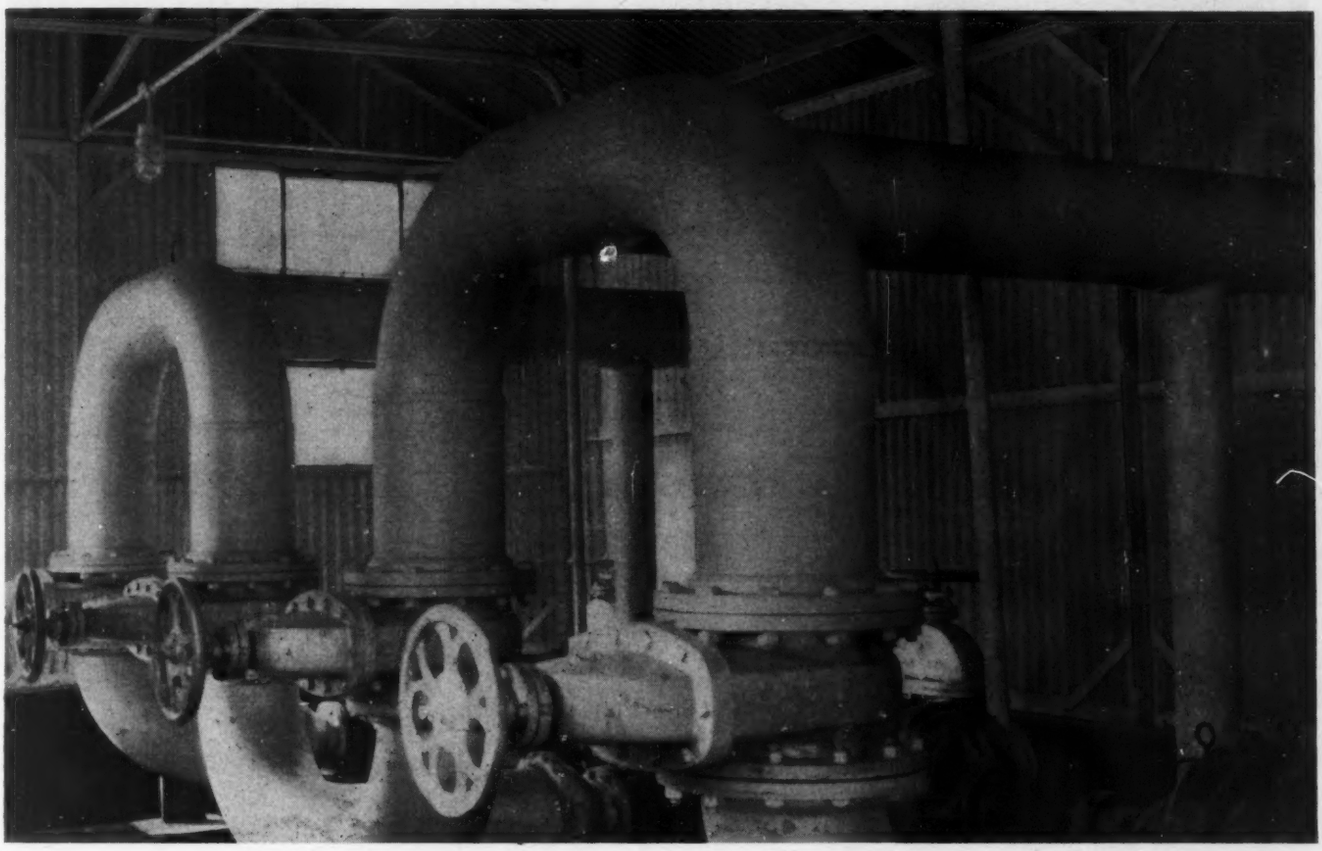
The gasoline, obviously, is of low gravity and frequently off-color as often is the case when a gasoline plant processes gas taken from flowing oil wells.

Material Saving

All of the compressor headers are elevated above the ground level to prevent soil corrosion, with the manifold connections between intake and discharge designed with pipe bends. The by-pass manifolds employed when starting a machine employ a minimum amount of connections and fittings. A single ox-bow bend is employed, which is welded to the intake side of the machine, arcing over to the discharge where a flanged stop is inserted in the line for control of the operation. The control stops are located at a convenient height for easy operation with the remainder of the connections consisting of a single nipple welded to the discharge line containing a companion flange at the top for bolting to the control valve. The intake-control valves are gates with the wheels high enough for convenient operation and the discharge valves are stops with extension stems terminating in a cross handle to prevent stooping.

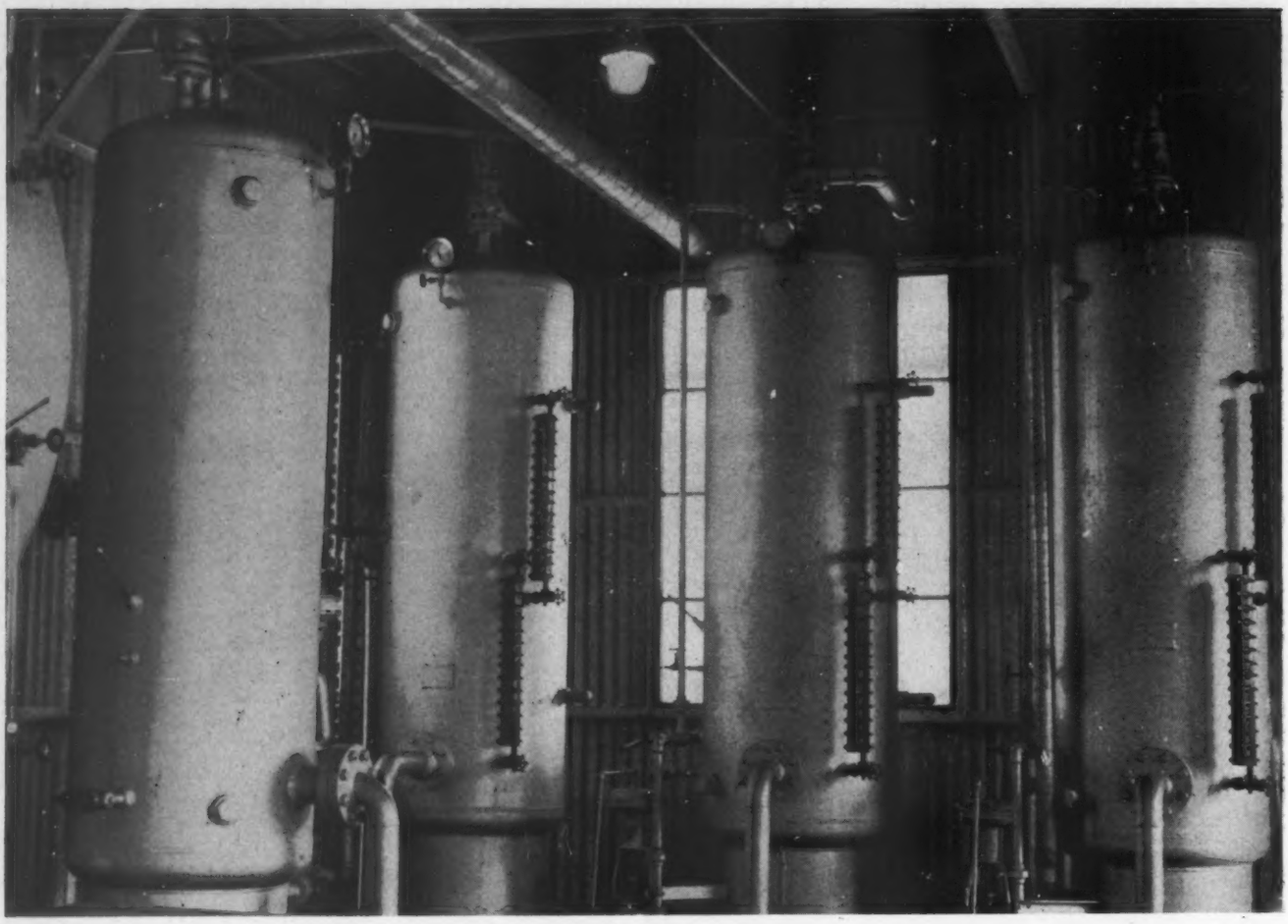
The high-stage compressors compress the gas to 300 psi, after which it passes through a second set of atmospheric coolers discharging into a combination accumulator and absorber scrubber. This vessel is placed beside the absorption column, and by using only one tank this method has resulted in the saving of several hundred pounds of critical metal, and the operation of the system is as efficient as the more conventional plan of using an accumulator to receive the condensate and a second tank at the inlet of the absorber. The gas leaves the combination accumulator-scrubber and passes through the high pressure column in the conventional flow, counter current to the absorption oil circulated in quantities sufficient to obtain an extraction of approximately 65 percent of the propane, and all of the butane and higher-boiling fractions.

The residue leaving the absorber passes through a dry gas scrubber which vents into the distribution manifold where the gas is divided according to the demand of the plant, the field and the gas transmission system. A set of pressure-control instruments installed on this manifold maintain the required back pressure on the extraction sections of the plant, and permit fuel to pass into the plant and field lines before any of the gas enters the industrial transmission system. Recording orifice meters are included in the apparatus on the distribution manifold so that measurements of all residue gas can be calculated and destination determined as to quantity.



Pump manifolding for the units which provide cooling water also show fabrication with a minimum of flanged fittings.

The absorption oil after coming in contact with the gas in the column is released through a liquid-level-controlled valve to a rich-oil vent tank operating at pressure comparable to the discharge of the first-stage compressors so that vapors released as the pressure is reduced can be vented to the compressors to be recycled. Passing from the vent tank through a set of conventional heat exchangers the rich oil enters the evaporator which contains steam-heated heating sections to maintain temperatures required for extracting or distilling the gasoline from the oil. Process or agitation steam is obtained from the low-pressure system in the plant into which all of the exhaust from all of the pumps is recovered before entering the boiler-feed system again. Vapors from



Reflux tanks are inside the control room.

the evaporator flow at once to the rectifier, or dephlegmator to process the commodity for end-point control. Two sets of vapor condensers are employed in series, having an intermediate accumulator from which the heavier fractions most easily condensed are pumped back to the rectifier as reflux. The condensate formed in the primary, or low-pressure-compression section of the plant is pumped directly to the dephlegmator where it is decolorized and processed for end point.

Since the low-pressure condensate in the compression section of the plant is more or less constant in volume, excess reflux is pumped from the primary vapor accumulator. Excess gasoline formed in the primary cooling of vapors in the first section of condensers flows with the uncondensed vapors to the second section where additional fractions are liquefied, all of which pass directly into the raw-make accumulator. Vapors which are released from this accumulator form the major load of the recompressor machines which maintain sufficient pressure on the condensers to liquefy a large portion of the gases. In turn, the condensate is pumped from the recompressor accumulator to the raw-make accumulator, or to the de-ethanizing column, commingling with the raw make at the column inlet. A liquid-to-liquid exchanger is installed in the de-ethanizer charge line through which both the charge to the column flows to be warmed by the stream of gasoline which is released from the de-butanizer column. Debutanized gasoline, or gasoline processed to a standard vapor pressure, is made in the debutanizer with that column reboiler maintained at 249 degrees, so that the exchange of heat between the processed gasoline and the de-ethanizer charge brings the temperature of the de-ethanizer charge to the required temperature for adequate processing.

Fractionating System

The de-ethanizer tower is 30 inches O. D. and 57 feet high, containing 30 bubble trays and operated at 370 psi with a reboiler temperature of 245 to 250° F. Ethane vapors from the overhead are liquefied only in sufficient quantity to maintain adequate liquid reflux which is pumped back to the column with an instrument-controlled pump. Excess ethane is released from the accumulator tank to pass into the field fuel lines or to the plant flare. The pressure of 370 psi maintained on the de-ethanizing column is utilized to pass the commodity directly from the reboiler control valve to the de-propanizer column, a tower which is a duplicate of the de-ethanizer, without pumping. Frequent boiling-point tests are made to determine the adjustments to be made on the controls of this column so that the overhead product will be of a composition having the least possible amount of i-butane.

The third column receives the de-propanized commodity without pumping, as the pressure held on the de-butanizer is 130 psi. The operation of the de-butanizer is varied frequently, depending upon the grade of natural gasoline required, which ranges from 14 to 26 pound, Reid. Overhead vapors, like those from the de-propanizer, are totally condensed,

Analysis of Field Gas

Component—	Percent	G.P.M.
Methane	75.75	....
Ethane	9.25	....
Propane	6.67	1.84
i-Butane	1.53	0.49
n-Butane	2.90	0.93
Pentane Plus	3.88	1.49
	100.0	4.75

and are a mixture of iso- and n-butane. Both these fractions flow into an accumulator which vents into a butane surge tank to maintain sufficient material for pumping to the next column at a predetermined rate. The fourth, and last column, is the de-isobutanizer, 48 inches O. D. and 106 feet high, containing 60 bubble plates and is normally operated at 102 psi with a reboiler temperature of 155° F. The function of this column is to separate the iso-butane from the normal fraction so that the overhead will have a purity ranging from 90 to 98 percent, depending upon the demand made by the purchaser.

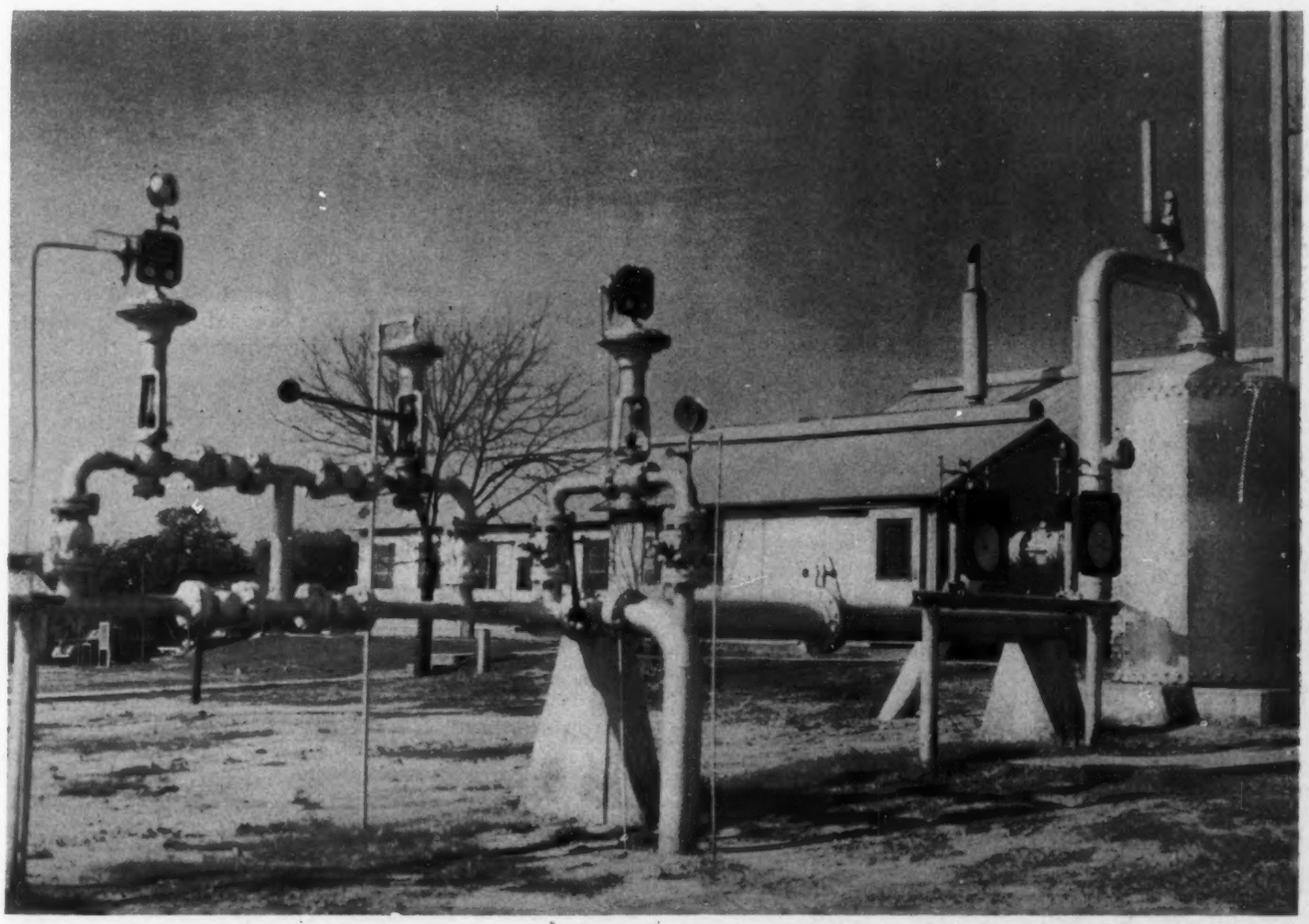
Steam System

The original design of the plant included a copper-treating unit through which all of the gasoline, after de-propanizing, was scheduled to flow, but subsequent analysis of the butanes and the stabilized natural showed that nothing was fractionated out of the commodity which would cause either of the butanes to be sour or corrosive. Only a very small quantity of sulphur compounds are in the gas and that which remains after fractionation is in the stabilized gasoline. This quantity is relatively small, and treating has not been difficult. Changing the flow in the plant to eliminate passing the gasoline with the butanes through the treating unit has reduced the tendency towards gas-lock and has also reduced the amount of liquid necessary for the treating unit to handle.

Two separate systems are installed in the plant to handle the steam. The first is the 300-pound system leading from the boilers to the pumps and some of the exchangers, while the second is the low-pressure system which carries the exhaust from all of the pumps.

Design of the plant and the equipment called for a 50-pound back pressure on the exhaust so that this steam might be used for processes and for heating various preheaters and some of the reboilers where the temperature is carried relatively low. Condensate from many of the heating units is trapped into a recovery system which leads the water back to the boiler room for feed water.

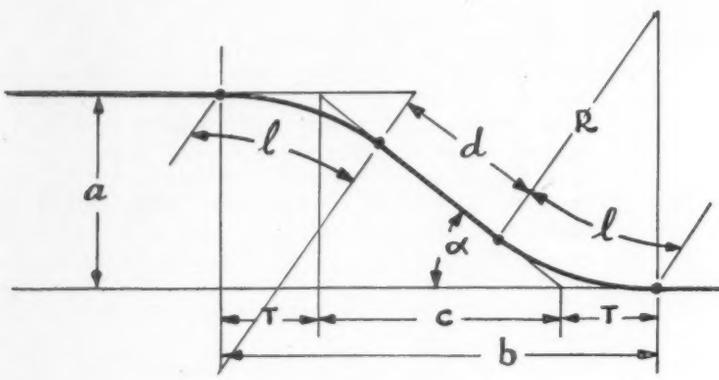
Water from the feed-water heater is pumped to the high-pressure condenser into which the boiler feed-water-conditioning chemicals are injected. Handling the chemicals is accomplished with a small proportioning pump mounted on the cross stand of the make-up pump so that the proportions of the treating compounds are always the same. Using this type of pump requires no electricity, nor is a separate prime mover required; the valve linkage on the pump operates the proportioning pump, which can easily be adjusted for greater or less of the compound as conditions change.



Residue gas control equipment.

Formula for Determining Length of Pipe in a Reverse Bend

IN PIPING detailing practice, the draftsman very frequently meets the following problem in various forms:



The problem is to find the length of pipe required to make a reverse bend. The known factors in the problem depend upon practical considerations. Four variables—a, b, R and α are involved and any three of these may be given. The following formula gives a relation between these four factors, making it possible to solve for the unknown factor when any three are given.

Referring to the diagram:

1. $b = 2T + C$

2. $T = R \tan\frac{\alpha}{2}$

$$C = a \cot \alpha; \text{ but } \cot \alpha = \frac{\cot^2\frac{\alpha}{2} - 1}{2\cot\frac{\alpha}{2}}$$

therefore

3. $$C = \frac{a\left(\cot^2\frac{\alpha}{2} - 1\right)}{2\cot\alpha}$$

Formula 1 may now be written as:

$$b = 2R\tan\frac{\alpha}{2} + \frac{a\cot^2\frac{\alpha}{2} - a}{2\cot\alpha}$$

If we multiply through by $2\cot\frac{\alpha}{2}$ and rearrange the terms, we get:

4. $$a\left(\cot^2\frac{\alpha}{2}\right) - 2b\left(\cot\frac{\alpha}{2}\right) + (4R - a) = 0$$

This formula 4 gives the relation between a, b, R and α.

In order to solve for a, b, or R when the corresponding three other terms are known, all that need be done is to substitute, and we obtain a simple equation in one unknown.

For example: if the conditions of the problem give

$$a = 24$$
$$b = 48$$
$$\alpha = 30°$$

then by substituting in formula 4 we obtain

$$24(\cot^2 15°) - 96(\cot 15°) + 4R - 12 = 0$$

from which

$$R = 12$$

Now the length of pipe may be obtained by means of standard formulas

$$l = \frac{\pi R \alpha}{180} = \frac{\pi(12)30}{180} = 6.28$$

$$d = \frac{a}{\sin\alpha} - 2T = \frac{24}{\sin 30°} - 2(12)(\tan 15) = 41.57$$

Therefore total length =

$$2(6.28) + 41.57 = 54.13$$

Supposing however that a, b and R are fixed by conditions of the problem, then we substitute in equation 4 and solve a quadratic equation of the form $Ax^2 + Bx + C = 0$.

For example

$$a = 24$$
$$b = 48$$
$$R = 12$$

then

$$24\cot^2\frac{\alpha}{2} - 96\cot\frac{\alpha}{2} + 24 = 0$$

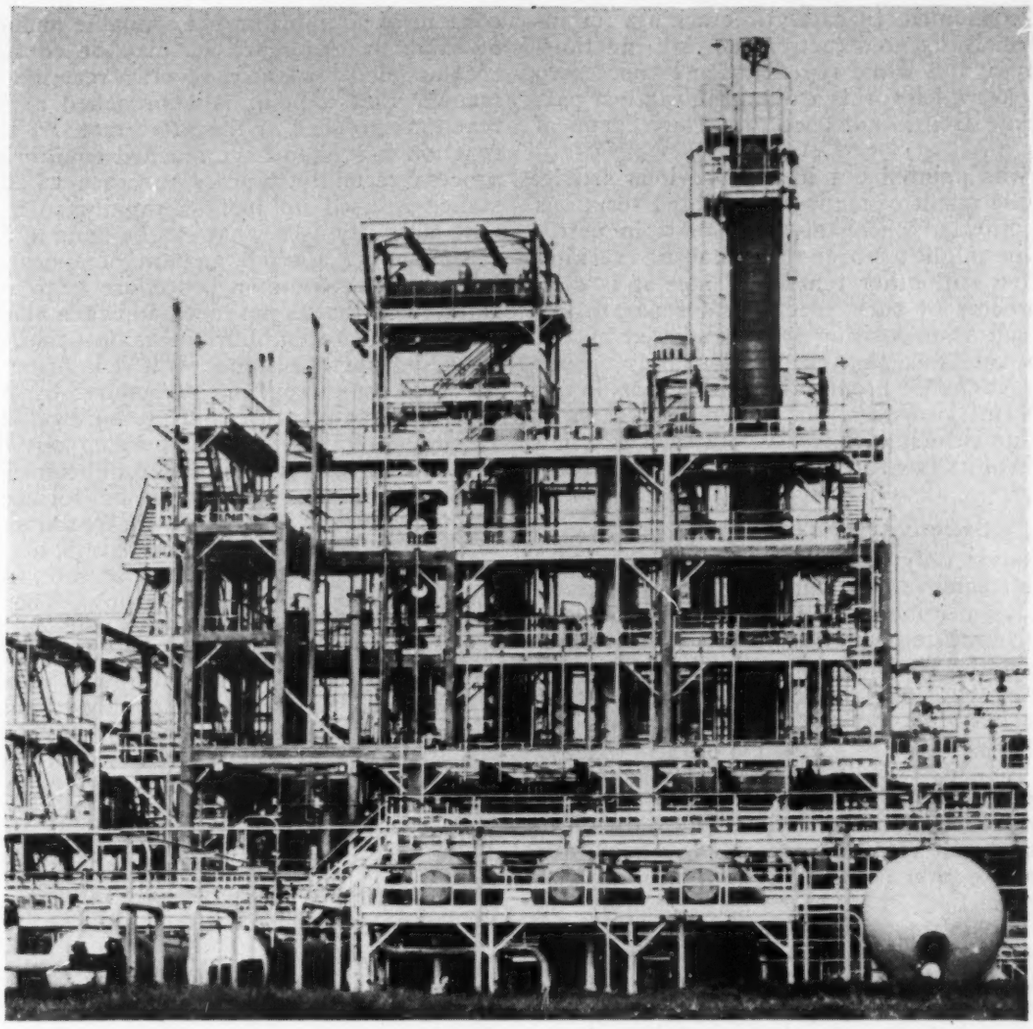
$$\cot\frac{\alpha}{2} = \frac{96 \pm \sqrt{96^2 - 4(24)(24)}}{48} = 3.73 \text{ or } .87$$

$\cot\frac{\alpha}{2} = .87$ is a spurious answer since α cannot be greater than 90° (or $\frac{\alpha}{2}$ must be less than 45°).

Therefore:

$$\cot\frac{\alpha}{2} = 3.732 \qquad \alpha = 30°$$
$$\frac{\alpha}{2} = 15°$$

Proper use of formula 4 will save the detailer and designer much valuable time in his work.



What Takes Place in Catalytic Cracking

PAUL H. FAUST, Chemist, General Petroleum Corporation

IN a previous article dealing with the chemistry of cracking[1] any discussion of the significant recent development of catalytic cracking was omitted with the thought that less confusion would result if this timely subject were to receive separate consideration.

The newness of this process should not lead one to the opinion that catalysis itself is a recent development. Sulfuric acid, ammonia, nitrates, hydrogenated vegetable oils, and many other common products have long been manufactured by catalytic means. In the petroleum industry, too, catalysis has played an important role from the beginning; for the action of sulfuric acid in treating is partially catalytic. Some of the other catalysts now in use in the industry are clay, phosphoric acid, aluminum chloride, and hydrofluoric acid. Refining methods that involve use of a catalyst include alkylation, polymerization, isomerization, hydrogenation and dehydrogenation, desulfurization, treating aromatization (e.g., toluene production), and hydroforming, in addition to catalytic cracking.

The present article is "directed" toward catalytic cracking, but since the most well-known variations of this process have been compared recently,[2] there is only brief reference to the actual design of the units. First, possibilities and limitations that apply to any catalytic process are discussed. Then, by application of these facts, a view of the actual mechanism of catalysis in cracking is suggested. The concluding paragraphs point out the utility of a knowledge of catalytic action in evaluating the catalytic cracking process and understanding its operating variables.

What Catalysts Do

A catalytic process involves a substance, the catalyst, which exerts an effect on the process without

itself being consumed. In catalytic cracking, for instance, a specially treated (activated) clay functions as the catalyst, and while regeneration is necessary to remove coke which forms around the catalyst particles, the clay itself is not used up in any chemical sense.

Now, as was pointed out in the previous article, cracking is the result of many complicated reactions among the different chemical compounds in petroleum oils. One might suppose that catalytic cracking would involve still other reactions since it is considered a process of such special and separate importance. Such a supposition is contradicted by the basic fact of catalysis, that the catalyst only speeds up reactions, it cannot promote reactions that do not otherwise occur. However, the catalyst may appear to violate this principle if it accelerates a reaction that, because of its low rate, ordinarily does not seem to go at all.

Selectivity of Catalysts

If the catalyst only speeds up things, why could not the result achieved by catalytic cracking be obtained simply by raising the tube temperature in a non-catalytic cracking unit? It is well known that heat increases the cracking velocity. The answer, as might be expected, involves the response of the individual reactions of cracking toward heat and toward the catalyst. A rise in temperature speeds up all the reactions of cracking with no regard for their comparative desirability .Catalysts, on the other hand, are selective in their action. A catalyst can be chosen that will speed up an ordinarily slow and unimportant reaction so that it becomes the predominating one.

Catalytic dehydrogenation illustrates this point well. The reaction involving the loss of hydrogen from a paraffin, "dehydrogenation," ordinarily occurs to a very small extent compared with actual splitting of the paraffin; but when a suitable catalyst is employed, dehydrogenation is made the predominant reaction. This particular example is receiving application in butadiene manufacture today, for butane and butylene are dehydrogenated to butadiene by a catalyst without which it is very difficult to obtain more than traces of the desired product.

Advantages of Lower Temperature

Since the temperature required to effect a chemical change may be lowered by catalytic action, catalysis is suggested when it is desired to carry out a process at a lower temperature. Fuel cost, heat exchange, cooling-water requirements, and corrosion rate may be reduced in this way. When the product is unstable toward heat a lower temperature may also be of great value.

A special case of product decomposition is when the original reactants are reformed, i.e., when the reaction is simply reversed. For example, in the case of isomerization (a process in which a straight chain molecule may be changed to a branched chain molecule) the backward reaction is sped up more by temperature rise than the forward reaction. This means, of course, that provided the reaction can be caused to proceed at a sufficient rate, a lower temperature is more favorable to the conversion of straight chains to branched chains.

A Digression on Equilibrium

The chemist refers to this interaction of forward and backward reactions as "equilibrium," and the concept of equilibrium is a valuable one in the study of catalysis. All reactions may be considered as if accompanied by their reverse reaction in such a manner that a point is approached at which both reactions proceed at the same rate. At this point, a reaction is said to have reached equilibrium, for the process certainly appears to cease when each substance is used up just as rapidly as it is formed. One naturally asks what can be done if, at this equilibrium, only a small amount of a desired product is present. A common procedure is to separate the small yield that is produced and then allow the process to come to equilibrium again—this is what the recycling operation does. But it is often possible to prevent costly recycling procedures by studying the effects of temperature and pressure on the reaction. It may be found that by carrying out the reaction at a lower temperature, the equilibrium is shifted so as to allow the product to be formed in larger amounts. Then, if the rate of reaction is impractically slow at this new temperature, a catalyst may be sought to increase the reaction rate, i.e., to hasten the attainment of the equilibrium. The catalyst, it should be emphasized, will not change the equilibrium; it can only speed up the process under circumstances where the equilibrium is more favorable.

The chief properties of catalysts may now be summarized.

1. A catalyst functions only as an accelerator of an already possible reaction.
2. The catalyst may exert its accelerating action among a group of reactions selectively.
3. In any individual reaction, the catalyst only hastens the attainment of equilibrium—it cannot shift the equilibrium.

A Molecular View of Cracking

Before applying these principles to the particular field of catalytic cracking it would be well to consider the process of cracking from the point of view of the actual molecules involved. If by some now inconceived method one could arrange to see these molecules, one would be able to contribute much to the present state of chemical knowledge. However, by devious means and over a period of many years scientists have amassed sufficient information that a pretty fair idea of the actual contortions of molecules in the process of chemical change can be had.

In thermal cracking the oil molecules might be likened to a swarm of blind insects which fly about at random, continually striking each other and glancing off in different directions. As the temperature is increased the molecules go faster until, when the cracking temperature is reached, they strike each other such damaging blows (by virtue of this increased speed) that they sometimes fly into pieces. Unlike the members of a shattered insect, should we wish to extend our unfortunate analogy, these fragments of molecules have a powerful inclination to form new molecules. This they may do, either by combining with the next likely thing they happen to strike, or, as probably occurs more often, by rearranging individually (involving hydrogen exchange) to form smaller molecules.

If there are present in the reaction space particles of certain activated clays, the molecules in their chaotic motion will often encounter the surfaces of these particles. It is the temporary interaction between certain groups of active atoms on the catalytic surface and the atoms of oil molecules that brings about the changes associated with catalytic cracking.

The forces between the catalyst and the oil are much like the chemical bonds which hold the atoms of the oil molecules together. These "catalytic bonds," as they might be termed, may strain or distort the oil molecules in such a way that they become more vulnerable to the continual bombardment by other oil molecules. Then, rupture of the "strained" molecules is effected by less violent collisions than otherwise would be necessary. This simply means that the cracking occurs at a lower temperature.

The fragments that result in this case are not immediately at liberty to fly off into space, since the catalytic bonds still hold them. (Obviously there must be bonds to each fragment in order for the causative strain to have been produced.) Being so confined, the chance is greatly increased that these fragments will recombine to form a new molecule as large as the original. In this way isomerization may readily occur, for nothing compels the fragments to reproduce the original configuration of the molecule.

In the cluster of oil molecules about active points on the catalyst, the molecular fragments are also offered an opportunity to make cross-combinations with fragments of other molecules. Such reactions would correspond, empirically, to the familiar processes of alkylation and polymerization.

Concern may be felt that the products formed have thus far been left stuck on the catalyst. Certainly, if there is not rapid interchange between the molecules on the catalyst and those in the surrounding space, the catalytic action will slow down to insignificance almost immediately, as the active areas fill up with hydrocarbons.

Actually, as was suggested earlier, these hypothesized catalytic bonds are only temporary—they are not strong enough to resist long the agitation of the surrounding molecules. When the molecular bombardment becomes intense enough to cause splitting and rearranging of the catalytically bonded molecules, it is more than sufficient to bring about dislocation of these molecules. Spaces are left for other molecules, and the cycle is repeated until before long, a little bit of catalyst may accomplish a lot of catalyzing.

Of course, the ultimate aim of cracking is to reduce the size of the molecules, while, as yet, the mechanisms described have resulted only in shape changing. Often, however, a collision may interrupt one of these reactions so as to free the fragments themselves from the grip of the catalyst. In this case the reaction may proceed, as in thermal cracking, to form individual molecules from the fragments, thus bringing about the desired reduction in size. This idea suggests the interesting point of view that catalytic gasoline occurs only as a result of interruption of the primary reactions on the catalyst. Lest such a conception seem too revolutionary, the presence of ordinary thermal cracking in the space surrounding the catalyst particles, as well as the existence of many other reactions on the catalyst, might be pointed out.

A Word of Caution

The foregoing section should be considered but a theory of catalytic action. Moreover, its presentation suffers from necessary limitations of both scope and detail; for, without employing a rather specialized vocabulary, this interesting subject cannot be reviewed comprehensively and effectively in the available space. Instead of attempting to survey the whole field of cracking, then, attention in this article is focused on just a few of the many reactions that might be considered. Furthermore, the intimate technical detail necessary for scientific accuracy is avoided. It is hoped, however, that in spite of these shortcomings, the mystery so often associated with catalysis has been reduced, and that a basis for understanding the operation of a catalytic-cracking unit has been suggested. Somewhat more practical ideas are brought out in the following sections.

Operating Variables

Familiarity with the nature of catalysis obviously can be of value in fixing the operating variables on a catalytic unit. One can predict the limit of conversion by a particular reaction from a knowledge of the equilibrium state, and the degree to which this limit will be approached, by the effect of the catalyst employed.

Consider butylene, demand for which has been increased by the synthetic-rubber program. Butylene may be formed either by dehydrogenation of butane or by splitting of larger molecules. But if increased butylene production compared to the total conversion of charge stock is desired, the relative speed of dehydrogenation must be increased. Equilibrium considerations suggest that a temperature increase favors dehydrogenation, and indeed, higher temperatures are being employed to increase the butylene yield.

In making a change, one should keep in mind its effect on other reactions. For example, the isomerization equilibria between straight and branched chains are affected undesirably by a rise in temperature. The over-all effect of a change in operating conditions obviously can not be predicted until the effect of the change on each individual reaction is known. This involves specific equilibrium data as well as knowledge of the catalyst's activity toward the individual reactions.

The Catalytic Cracking Unit and Its Operation

The flow of the catalytic unit is not a radical departure in petroleum refining, for the combination of thermal cracking with vapor-phase clay treating involves a sequence of operations very similar to that of catalytic cracking. The major difference in flow is that in catalytic cracking the entire discharge from the furnace (or tar separator) and not just the gasoline cut, is contacted with the clay catalyst.

The Houdry, Fluid, and Thermofor processes constitute the important commercial application of catalytic cracking today. Their operation differs, essentially, only with respect to the handling of the catalyst. In the oldest, the Houdry process, it remains in situ throughout the reaction and regeneration steps. In the others, the catalyst is circulated through separate reaction and regeneration chambers. The Fluid process suspends its catalyst as a fine powder in the streams of oil vapor and regenerating air, respectively. The Thermofor process employs granular catalysts flowing countercurrent to these streams. In the latter case the granules cascade downward over baffles in the reactor, and over spiral fins on heat-exchange tubes in the regenerator.

The regeneration step involves burning a carbonaceous deposit off of the catalyst in the presence of a circulated, heat-absorbing medium so that the ma-

terial is not permanently deactivated by excessive temperatures. In case a tar separator is employed following the furnace, the charge to the reactor is superheated to reduce temporary deactivation of the catalyst by discouraging condensation and resulting formation of a liquid film on the catalyst grains. If "non-residuum" operation is used, the total furnace discharge is admitted to a preliminary catalyst chamber in which the coking out on the catalyst may amount to several percent.[3]

The Catalyst Itself

The catalysts used in petroleum cracking are specially prepared, either natural or synthetic clays. There are different types corresponding to the specific reactions that are to be catalyzed.

Study of the surface of these catalysts is one of the newest, most fundamental branches of research carried out by the major oil companies. Localization of catalytic activity upon the catalyst surface has been mentioned before. The existence and nature of these active spots is the result not only of very precise compounding but of carefully controlled processing steps. Very small amounts of some impurities may exert profound effects—sometimes good, in which case the impurities are called promoters; and often bad, when they are called poisons. The catalyst, then, is by no means a thing to be taken for granted.

Thermal vs. Catalytic Cracking

The two methods are utilized for the same purpose—conversion of heavier petroleum cuts to gasoline. They may be compared, then by comparing the products as well as the operating conditions.

When comparing the gasolines produced, one is impressed most, perhaps, by the remarkable superiority in octane rating of the catalytic product. This superiority is largely explained by a distinction, suggested above, between the two types of cracking. Practically all of the gas and gasoline from the thermal unit is formed by splitting the charged molecules directly, while that from the catalytic unit is produced by splitting these molecules after a large portion of them have undergone structural rearrangements. By such mechanisms as have been outlined, reactions that bring about these rearrangements are catalyzed. Since many more branched-chain molecules, with their superior octane numbers, are present in an equilibrium mixture than are ordinarily found in thermal cracking yields, the further approach to equilibrium in catalytic cracking is beneficial. This shows exactly why the catalytic method results in a product of superior octane rating.

The fact, already mentioned, that at lower temperatures the equilibrium is more favorable toward branched chains, results in a further, though not so significant, improvement in the octane number.

While the production of highly branched compounds is perhaps the most notable achievement of catalytic cracking there are other factors such as sulphur reduction, aromatization, and desirable positions of chain splitting that combine to add superiority to the yield of the catalytic unit. Catalytically cracked gasoline, by virtue of its low sulphur and gum contents is the only cracked product that may be burned in aviation engines.

In the gases, high ratios of iso-butane to normal butane, and of the entire butane-butylene ("B-B") cut to total gas are features of special importance now, since they combine to make catalytic cracking an ideal source of charge stock for both alkylation and butadiene plants.

Considering the economics of the catalytic versus thermal problem, the advantages of catalytic cracking must be weighed against its higher cost, both of construction and of operation, for the savings in construction of a low temperature and pressure unit do not counterbalance the extra expense involved in equipment for handling the catalyst.

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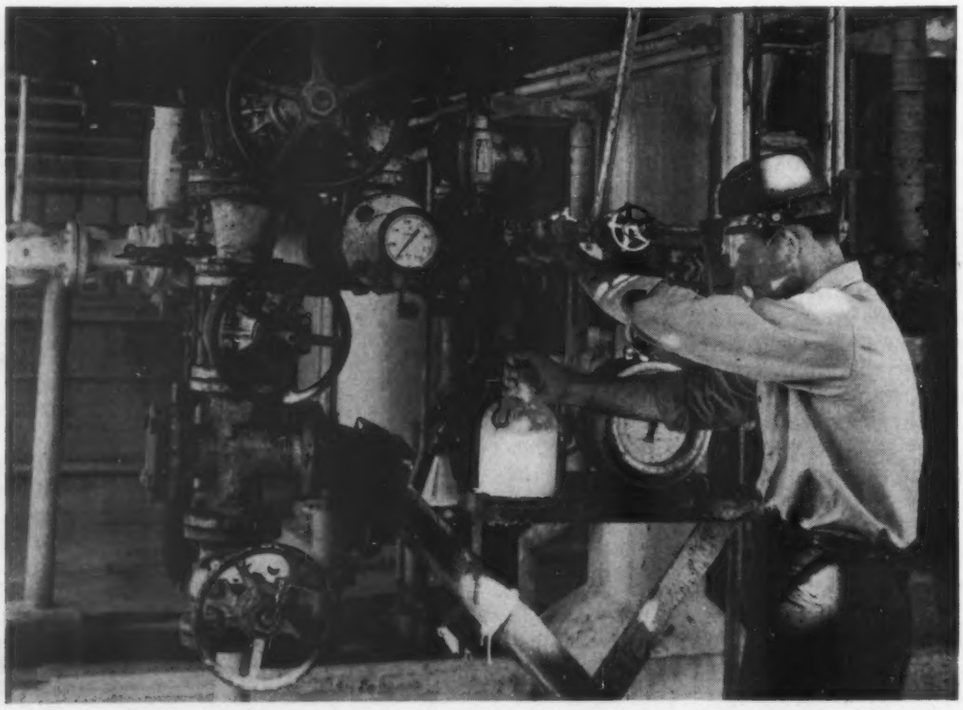


Maintenance Kinks Prolong Motor Life

ELTON STERRETT

TOPPING the long list of critical equipment items necessary for carrying on oil production stand those electrical units involving large amounts of copper, especially the motors and generators used on diesel-electric rig operations, motor-converter sets, and the A-C and D-C motors required for driving oil-field equipment.

Perhaps because the units are built of comparatively few separately moving parts, and with little apparent possibility of wear, they are regarded by many switchers, roustabouts and roughnecks as being so ruggedly constructed as to absorb unlimited abuse, and to need no maintenance other than an occasional squirt of lubricant into each of the two main shaft bearings.

Much useful life is being added to electrical equipment through the addition of protective devices which reduce the amount of dust reaching the unit. Dust in the bearings is effectively screened out by the motor manufacturer, with the lubricant seals which prevent leakage past the bearings, and by the provision of some effective cover on the lubricant well. But the most serious effect of dust and dirt is felt in the windings. Motors—and this also applies to generators—are heat-producing machines, a portion of the electrical energy within them being transformed into heat, which must be radiated or conducted away if the temperature rise is not to pass the point where insulation is endangered and breakdown invited.

It is in the clogging of air passages, and in the building-up of a heat-insulating coating over wind-

ings that dust is the most serious saboteur of motor life. Since the cooling effect of a current of air over the winding is dependent upon contact with the heated insulation to effect heat-transfer, it is evident that a relatively thin coating of dust can lower the rate of heat transmission to the point where the winding is exposed to temperatures greater than those for which it was designed. Dust also tends to eddy and settle out in any change of direction in the air passages built into a motor for the forced-draft cooling required by many types. This draft, varying with the type of motor and service, is relied upon to carry cooling air currents throughout the unit, and due to limited clearances, is frequently confined to extremely narrow passages. The accretion of relatively small amounts of dust within these passages not only cuts the air flow by reducing the cross-sectional area of the passage, but also changes the friction coefficient by adding roughnesses which did not exist in the design.

The dust drawn into an electrical unit by the ventilating system may be relatively oil-free, or may be mingled with tiny droplets of oil in the air stream. Once either type of dust is deposited within the motor, it becomes a pad or sponge which tends to trap and hold any oil or moisture present, forming a focal spot for the attack on the insulation by the oil carried in the deposit. Such oil action not only reduces the insulating effect of the material, but frequently causes it to swell, deranging the delicate rotating balance of the motor, and even causing distortion to the point where actual contact is made across the normal operating clearances between rotating and fixed portions of the unit.

Dust Prevention

The time to combat dust is before it reaches the motor. If not compacted by oil or moisture, much of the deposit may be blown or sucked from a unit by compressed air or a vacuum cleaner, but such an operation requires a shutdown of the unit, and is never completely effective.

Where ventilating ducts on a unit normally point downward, being so designed to avoid trapping falling particles of dust, horizontal extension of the entrance ducts away from flooring, especially if the motor be placed close to a walkway, greatly reduces the amount of material carried into the windings. Equipping the motor with an air-cleaner, especially of the oil-bath type, is apt to result in the substitution of oil droplets for the dust, resulting in accelerated deterioration of the windings and excessive shop maintenance. Filter-type air-cleaners, in which sufficient area is presented to insure against stifling the motor through constriction of flow, greatly extend motor life, and are a must under war conditions in areas where the dust is sufficient to form a noticeable coating on smooth, painted surfaces over a 24-hour period.

Where motors are operated in explosion-proof booths, screening or filtering the inlet air and provision of a duct to the outside for such air as has passed through the unit takes advantage of the tight enclosure and reduces the time during which dust entry can occur to that required for periodic examination of the unit by the operator.

Since the windings of a motor are not readily visible, and in some types of motors can be examined only by removing cover plates, the presence of dust is often not suspected until failure occurs. If dust settles on stationary equipment in still air, it is safe to assume that equivalent areas within the motor are exposed to from four to as much as 20 times the dust deposited by normal room ventilation currents, and the maintenance schedule should be planned accordingly.

When the motor is used where the dust includes abrasives—and this includes operation in a building where a bare or unpainted concrete floor is present—use of an air jet for removing the accumulated deposits may introduce a hazard even more serious than the presence of dust in the windings. High air pressure on a jet will tend to drive the abrasive particles in the dust into the windings, out along the shaft to the oil-sealing rings, and even into the bearings themselves. Particles freed from their resting places are set in motion and given a velocity so high that they do not follow the air stream, but deposit again at the first abrupt change of direction, and thus may be carried farther into the unit instead of being removed.

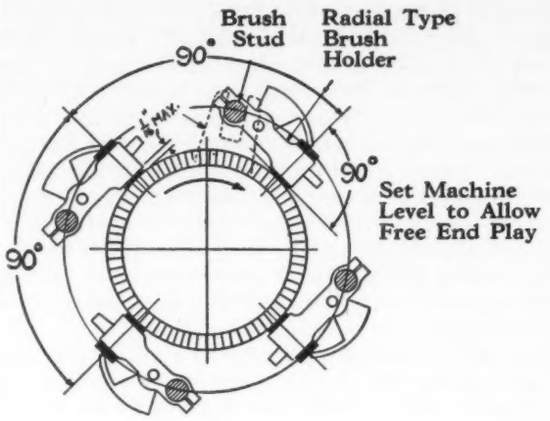
Many maintenance men, when using air for cleaning a motor, restrict the pressure to a maximum of 30 pounds per square inch on the hose carrying the nozzle. This pressure, expanded through a flat or conical nozzle, gives flow enough to loosen dust deposits without building up high velocities to cause cutting of insulation or re-bedding of the material.

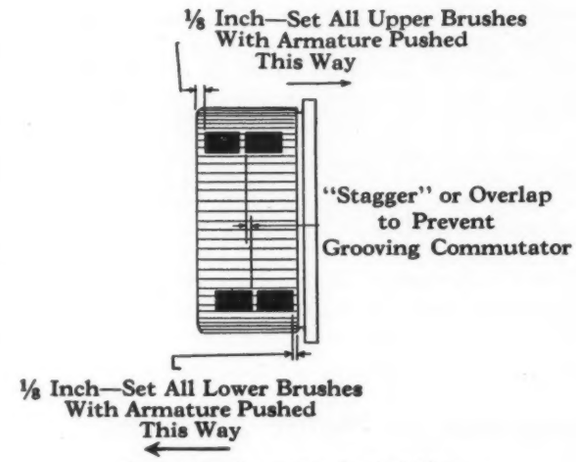
In most instances, it is possible to observe the precaution of blowing through the unit opposite to the normal flow of cooling air. This tends to pick up the fluffier material which has carried deep within the windings and to remove the heavier deposits near the entrance to the ducts without necessitating travel through the remainder of the unit. Some maintenance men have found that the combination of a vacuum at the (normal) entering passages of the motor ventilating system with a low-pressure jet at the other end of the ducts, results in loosening and removal of a higher percentage of the deposits than can be secured by use of either method alone.

When the accretion of dust and oil within a motor has produced a coating which resists all efforts to dislodge it with air currents, scraping may be required. Use of metal scrapers is extremely dangerous, as the insulation underlying such a deposit may be softened and easily scraped away with the gummy deposit, or if not removed, may be broken down so as to expose the wire within. Wooden scrapers are slower than metal ones, but are much safer, and the additional time thus expended is more than balanced by the extended insulation life.

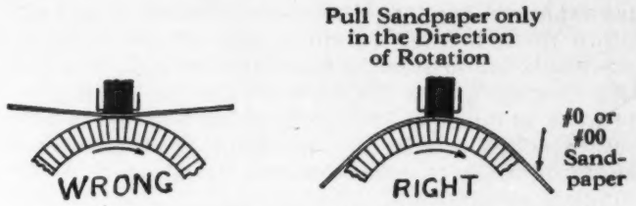
Even scrapers sometimes fail to remove deposits, and a solvent must be used. If this remedy is indicated, and it must be done in the field, solvent should be used sparingly, taking care not to soak the insulation. Many solvents which dissolve the gummy deposits also tend to soften insulation, and thus may do more harm than good. Also, some solvents are highly explosive when vaporized, and may remain within a motor in proportions of an explosive mixture, awaiting only a spark to explode and damage windings or even wreck the unit.

Carbon tetrachloride—used with proper precautions to safeguard the operator—is non-explosive, and effective on most gummy deposits. It should be used sparingly, to soften the deposits and permit their removal by scraping, rather than in flood sufficient to wash them away. Gasoline, kerosine and other petroleum-base solvents dissolve or soften rubber,

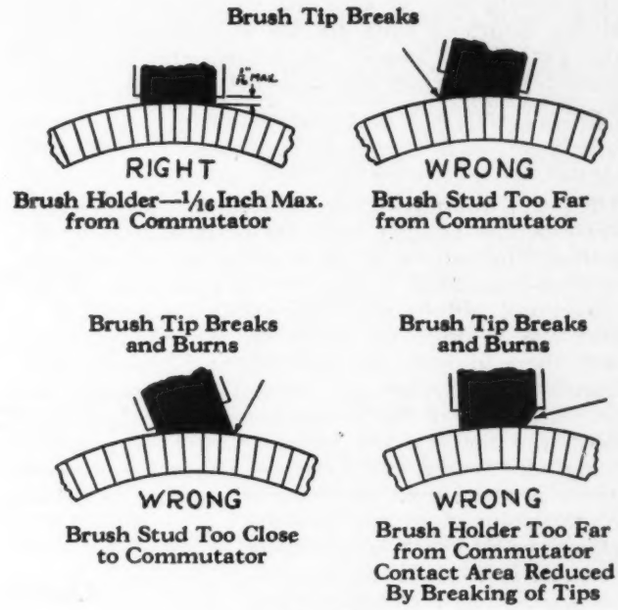



⅛ Inch—Set All Upper Brushes With Armature Pushed This Way
"Stagger" or Overlap to Prevent Grooving Commutator
⅛ Inch—Set All Lower Brushes With Armature Pushed This Way

Instructions for setting brush holders.



How to hold sandpaper when seating brushes.


Brush Tip Breaks
RIGHT
Brush Holder—1/16 Inch Max. from Commutator
WRONG
Brush Stud Too Far from Commutator
Brush Tip Breaks and Burns
WRONG
Brush Stud Too Close to Commutator
Brush Tip Breaks and Burns
WRONG
Brush Holder Too Far from Commutator Contact Area Reduced By Breaking of Tips

Causes of brush failure.

and are apt to leave the windings in worse condition than before removal of the gummy deposits.

Some of the chemical cleaning agents, used in water, act quickly to soften the gummy accretions, but must be used with care to prevent flooding the windings. Lye and similar reagents, while loosening the oil binder of deposits, also attack the fibrous covering of the insulation, and may cause more extensive deterioration than the original material.

Drying Motors

Motors which have been under water, even for only a few minutes, are sure to have all the lubricant floated away from the bearings, and more or less water-borne grit deposited in its place. This alone demands dismantling of the unit and thorough cleaning.

When such a unit is dismantled, it is often reassembled prematurely, the surface of the windings appearing dry and giving no hint of the water held within the turns by capillary action. Drying may be accomplished simply by placing the unit in the sun, turning at intervals to permit the warmth to reach all parts of the winding and cause gradual evaporation of the moisture.

Where an oven is available, the motor may advantageously be placed within it, and the heat regulated to remain under the critical temperature of the windings. This may be calculated roughly from the critical data carried on the motor name-plate. If the motor is designed for a 40° C. rise, and normal temperature of the surroundings does not exceed 100° F., the oven temperature may be set to reach $100 + 40 \times \frac{5}{6}$, or 172° F. without exceeding safe temperature for the windings. Many maintenance men choose to disregard the conversion factor from the usual name-plate limits in degrees. Centigrade, and set oven controls to cut off at the arithmetical sum of working and safe overload figures, which, in the example cited, would call for not over 140° F. as maximum. Such drying may require a little more time, but is then sure not to overheat any part of the windings. One motor-maintenance unit, charged with the upkeep of more than 200 units of from 5 to 15 horsepower, uses an electrically heated hair drier of the fan and element type to provide gentle circulation of warm air through the windings.

An ordinary ventilating fan, set up behind hot elements, steam pipes, or even blowing around the hot exhaust pipe of an internal-combustion engine, will provide the required warmth to accelerate drying, though in such a case care should be exercised to see that the fan does not stir up dust and begin deposition of a new coating inside the windings.

Current may be circulated through the windings and heat thus produced within them, driving the moisture outward. If such a method be used on a motor, the armature must be blocked to prevent rotation, and a rheostat cut into the heating circuit to provide regulation ample to permit the tempera-

ture within the winding to be held under the design maximum. Where a thermometer cannot be set within the windings to check this temperature, it may be placed outside the windings and held in place with insulating tape. In such a case the reading is apt to be as much as 10 degrees lower than the maximum reached within the windings, and provision should be made to allow for this variation.

Following any immersion or serious wetting of a motor, requiring drying by any of the methods outlined, the unit should be given a coat of good insulating varnish before being restored to service. Such a unit should also be checked carefully during the first few hours of such service at full load, during which period any interior breakdown should become apparent and permit removal before even greater damage be sustained.

Lubrication

The very simplicity of lubricating motors frequently works against the best maintenance of the bearings. The ball- or roller-bearing type of unit may be grease-lubricated, in which case great care should be exercised not to add so much grease that it is forced out through the seals on the inside of the motor, there to reach the windings and cause trouble. Where such bearings are packed with grease and then sealed within the motor housing by dust-proof covers, the tendency is to use plenty of grease—"plenty" in nearly every instance being too much. If there is more than the required coating of grease over the component parts of the bearing, work must be done on the excess to force it through relatively restricted clearance passages with each revolution of the motor. This work results in liberation of heat which, in turn, thins the grease and may render it unfit for the requirements of the motor.

It is sufficient in most cases if each unit of the bearing be given a thin coating of the proper grease (and for this the motor manufacturer's recommendations rather than the type of grease made by the company should be followed). When such greased units are assembled, any inequalities in distribution are quickly compensated for by rotating of the unit, and any slight excess crowded into the clearances of the bearing without unduly heating it.

Maintenance crews have found that some motors, turned in for overhaul, have been forced from service simply because the bearing was filled so full of grease that rotation of the members was prevented, and the balls or rollers then had to act as a sleeve bearing, with reduced contact area and consequent highly accelerated wear.

Where bearings are lubricated with oil, any expenditure for the proper grade and type of oil over and above that chargeable for ordinary (gas-engine) oils pays dividends many times in prolonged operating periods.

Unless prolonged non-stop runs are required, all additions of oil should be made with the unit at rest. Ring-oiling devices, provided with a sight glass to show oil level, do not indicate the amount in a bearing while running, it being possible to add enough oil to flood a bearing without any of the excess reaching the glass. If the sump is provided with the overflow or set-level type of inspection outlet, the addition of oil should be made long enough after the unit has stopped to allow oil throughout the bearing to reach the sump and thus indicate the true amount already present.

Excess oil is forced through the oil seals, and works out along the shaft, to find its way into the windings and cause premature breakdown of insulation. Many operators, finding a line of oil spots up the motor-room wall, believe that all the excess oil is thrown off by centrifugal force immediately after working past the bearing cap. Much of the waste oil is thus removed, but a film may be observed to creep along the shaft, over any shoulders which may exist, and thus to attack the windings. Installation of a sling ring just outside the bearing, where wear prevents adequate oil seals from being maintained, will care for normal bearing leakage, but should not be relied upon to exclude over-oiling surplus from reaching the windings.

Motor manufacturers specifying lubrication schedules for their equipment, unless the motors are known to have been designed especially for oil-field service,

Quick Diagnosis of Motor Ailments

Symptoms You Can See

Symptom	Possible Causes	Cure
1. Excessive sparking or flashing at brushes. Blackened commutator.	Rough commutator.	Sand or turn down, depending on depth of surface roughness.
	Low bar on commutator.	Grind or turn down balance of commutator.
	High bar on commutator.	If extreme, lower with mallet . . . tightening clamping ring. Grind true.
	High mica.	Undercut.
	Brushes too short.	Replace—with harder grade— if worn too soon . . . and not by rough commutator. (Sometimes **underloaded** brushes wear abnormally fast.) Ordinarily, set should last for a minimum of 2,500 hours.
	Insufficient brush tension.	Adjust.
	Weak brush springs.	Replace.
	Brushes sticking in holders.	Free them. Clean brushes and holders.
	Dirt or oil on commutator.	Wipe off. Clean brushes if glazed.
	Water dripping on commutator.	Plug source—or rig shield.
	Shorted armature winding.	Test for short—after removing metallic contact between commutator bars. Repair armature.
2. Intermittent sparking at brushes.	Open armature winding.	Locate and replace bad coil—or repair defective joint.
3. Fine dust under coupling employing rubber buffers or pins.	Misalignment.	Realign set.
4. Smoke, charred insulation, or solder "whiskers" extending from armature.	See item 12; but if evidence is of **past** overheating, check for loose soldered connections that might cause future trouble.	
5. Motor won't start.	Usually line trouble—single-phasing at starter.	Correct. Check source of power supply. **DON'T merely try to make it go—while motor sits there and "fries"!**
	Load too heavy. Disconnect motor to see if it starts without load.	Reduce load—or replace motor with unit of greater capacity.

frequently figure on an 8- or 10-hour operating day and a 5-day week, whereas much pumping equipment is run on a 24-hour, 7-day basis. This stepped-up operation resulted in the changing of inspection and lubrication by many companies to call for as many as four rounds to one previously. On such a basis oil sumps in ring- or chain-oiled bearings should be drained and flushed at monthly instead of quarterly intervals, and even more frequently if the drained oil shows the slightest tint of "color" or fouling.

Many bearing failures, formerly charged to lubrication failure, are now being avoided through complete check of motor-operating conditions and the relieving of any overload thus found. Although not in itself an item of motor maintenance, proper tension in the chain or belt drive between motor and driven unit is highly important. When it is realized that the oil film separating shaft from bearing—in the case of a sleeve or plain bearing—is no thicker than the wall of a soap bubble, it becomes apparent why overstressing such a thin coating of oil can result in its breakdown, metal-to-metal contact, and a burned-out bearing or wrecked unit. Frequent check of belt or chain tension, with prompt adjustment if the slack falls within recommended units, pays large dividends in extended motor bearing life.

With growing difficulty in securing replacement units, or even of acquiring the necessary material for home repair of motors, many maintenance crews no longer stop with the simple operation of removing a failed unit and its replacement with a reconditioned one. The unit on which the failure occurred is kept out of service long enough for a few routine checks, and any abnormal conditions corrected before installing the replacement.

Since almost any bearing failure sets up heat enough to vaporize or burn the relatively small supply of oil or grease in the bearing, it was formerly thought that any bearing failure was inherently a lubrication failure. Study of the set-up, or if conditions prevent that, a close watch over the replacement unit during what would normally be considered a breaking-in period, usually brings to light the contributing cause behind the actual motor trouble.

In the motors themselves, nearly every change in operating conditions which sets up possible failure factors becomes evident in one manner or another. Vibration, especially any increase over that normally observed in a unit, is direct evidence of unbalance. This unbalance may be electrical, in the case of three-phase units indicating possible looseness in one terminal, probable failure of the transformer feeding into the motor, or unbalance of the phases through addition of new units on the common power lines. The unbalance, if mechanical, may indicate the formation of dust-and-oil accretions or, as happened in a number of outdoor installations, the building of mud dauber nests on the windings while stand-by units were idle. It may also indicate the dislocation of one or more of the windings, due to swelling of the insulation, breakdown of the anchorage, or the sloughing off of a portion of the insulation due to action of oil, acid fumes, steam or dry heat.

Such unbalance may also be the lasting evidence of some abuse or overload which the motor has been called upon to carry, and which may be located as sprung shaft or warped bearing. One such case, in which a motor which had been running satisfactorily for years suddenly began to vibrate dangerously, was traced to the dropping of a wiping rag onto the slack side of the V-belt drive, the rag being carried around the motor sheave and dropped clear after

Quick Diagnosis of Motor Ailments

Symptoms You Can *Hear*

Symptom	Possible Causes	Cure
6. Excessive hum.	Uneven air gap. Measure with feelers.	Replace bearings—**before** introduction of scraping noise indicates rotor is rubbing against stator.
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band—or weight attached by cap screw and lock washer.
7. Regular clicking.	Foreign matter in air gap.	Take out rotor; remove matter.
8. Rapid knocking.	Misalignment—probably causing shoulder of shaft to pound periodically against bearing end.	Realign set until knocking disappears.
9. Brush "chatter."	Extreme motor vibration.	See items 10 and 11, below.

Symptoms You Can *Feel*

10. Vibration.	Misalignment.	Realign set.
	Vibration in driven machine. Run motor disconnected for check.	Eliminate source in machine, if possible. Or change to a flexible belt drive may be in order.
11. Vibration—**following motor repair.**	Rotor out of balance, due to holes drilled or weight shifted . . . new rotor coil or coils.	Balance rotor.
12. Motor over-heating. (Check with thermometer—don't depend on hand).	Overload. Measure load; compare with nameplate rating.	Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with unit of greater capacity.
	Dirt in motor. Check flow of ventilating air.	Blow out motor. Use solvent on wound section if necessary.
	Rotor rubbing on stator.	Replace bearings.
	Shorted stator windings.	Test with wattmeter and correct.
	Ground.	Locate with test lamp or growler and repair.
13. Bearing over-heating.	Misalignment.	Realign set. And in this—as in all cases of bearing over-heating—**keep shaft turning** until bearing is cooled . . . to prevent "freezing."
	Too much tension in chain or belt drive.	Reduce tension to point of adequacy.
	Excessive end thrust.	Reduce thrust from drive or machine. (Shaft should be permitted reasonable "axial" float.) Or if motor is off level, shim up lower end to take thrust off its bearing.
	Too much grease (ball or roller bearing).	Relieve supply to point set by manufacturer.
	Sticking oil ring (sleeve bearing).	Clean, repair, or replace—as necessary.
	Insufficient lubricant.	Add—up to point set by manufacturer.
14. Commutator hot.	Incorrect grade of brushes.	Replace with proper grade—as specified by manufacturer, unless otherwise indicated.
	Excessive brush pressure.	Decrease brush spring tension.

a single passage through the drive. Shock of the impact of this obstruction against the sheave and overstressing of the belts through greatly increased tension bent the shaft; not outside the bearing, but between bearing and armature. The resulting unbalance, though not causing actual rubbing, was sufficient to endanger the unit and to require immediate replacement. Accidents such as this are being guarded against with elaborate guards and shields, and by tight enclosures when chain drives are used.

Where the motor itself is not harmed by an accident such as the one mentioned, the strain may derange the motor or driven-unit mounting, and thus introduce a condition of shaft misalignment which greatly overloads the motor.

Increase in motor temperature, when the load remains relatively constant, is indication that shaft alignment or shift in drift relationship has occurred. Close check of motor temperatures, or at least a temperature-overload relay, is now indicated where motor temperatures vary suddenly. Correction of the drive conditions which cause this overheating, while not directly motor maintenance, contribute largely to longer and more trouble-free motor life.

Vibration must be located as to source before it can be eliminated. One servicing unit checks in the following order unless there is direct evidence that a short-cut may be taken to discover the trouble. First, all mounting bolts are tightened and, if rubber mounted, the pads are checked to see if any has become oil-soaked or worn below the others; then the motor is checked for loose parts.

The foundation or mounting is then checked with that of a similar non-vibrating unit of like load and characteristics, if such be available. Bearings are then checked for looseness, and clearances adjusted or taken up when in excess of two thousandths of an inch plus one thousandth for each inch or fraction of a inch of journal diameter.

The vibrating motor is disengaged from the machine it drives. If it operates far more smoothly at full speed and no load when disconnected, the driven unit probably is at fault and should be checked.

If the vibration seems to date back to the last overhaul or repair, the rotor should be checked for balance—dynamic balance if possible or equipped for this test, static balance in any event. If found out of balance the needed weight should be attached to the rotor at the appropriate capscrew, hooking the weight around part of the motor to relieve the capscrew head of the centrifugal force set up in the weight at operating speed.

Since slip rings and commutators cannot be lubricated, wear at these points is expected. Wear distribution at these points can be reduced by frequent wiping free of collected dust and grit. Every precaution taken to prevent oil from reaching these surfaces pays high dividends in extended wear. Any roughness of these surfaces should be remedied at once, before continued operation can invite grooving, pitting, sparking and similar "electric" wear as contrasted with normal operating frictional abrasion.

Many repair and maintenance units true up a commutator with a commstone in a suitable holder, simply by holding the device against the unit while rotating within its own bearings. Such truing, when effective, is economical of commutator metal, and generally removes less than half that taken off by even the lightest truing cut in a lathe.

When commutators are turned down, the mica separating bars must be relieved to a depth of about 1/32-inch. Unless undercut, mica is the cause of much brush wear and excessive sparking. Undercutting of the mica should not be done with a knife or other sharp edged tool, but preferably with a hacksaw blade, ground free of clearance and to the thickness of the mica.

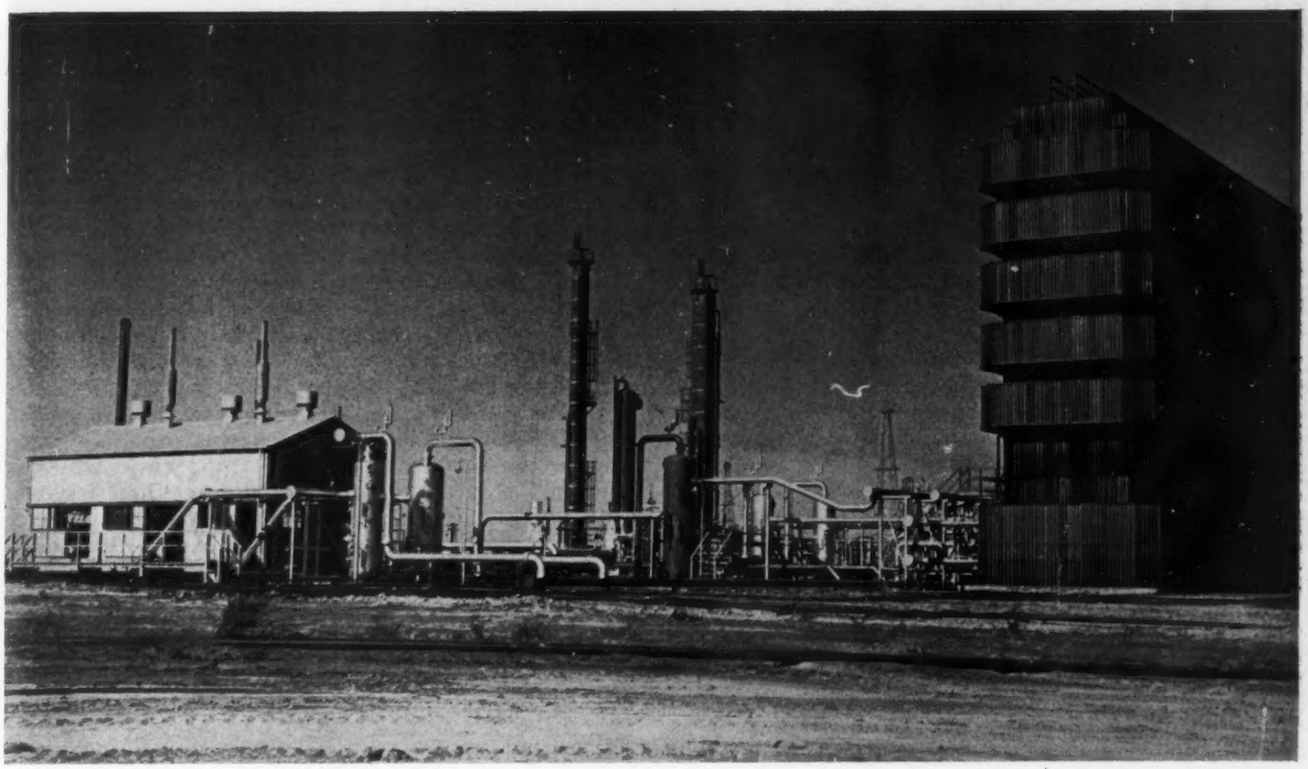
If a motor with sleeve bearings is observed when running normally, it will be seen to shift laterally in its bearings between the normal position when at rest and when running at speed under load. This lateral shifting within the bearing is necessary to distribute bearing and commutator wear, and prevents or largely forestalls grooving. If this shift is not present, a change in motor or driven-unit alignment frequently is found to permit this "floating" and motor life thus extended.

Field motors are being equipped wherever possible with overload protection, and even, in locations where the known loading imposes temporary power peaks above the unit rating, with recording devices whereon is shown the actual motor temperature during each cycle of operations. Overload units, formerly remaining inoperative over periods of years under normal conditions of motor operation, are checked at frequent intervals to determine their accuracy and reliability, and fuses calibrated against their ratings to insure against overloading or overheating a motor through excessive capacity of safeguards.

Reduction of load in certain types of drives has been found to introduce a type of motor trouble due to underloading instead of the opposite. Where reduced production on a well cannot be cared for by intermittent pumping, an induction motor may be underloaded to the point where the wattless current, that used in producing the magnetic field in the motor, is out of balance with that energy required to produce mechanical energy. Thus power factor, or ratio of real power to total power is lowered. At underload, the induction motor is operated under four disadvantages: it has higher line losses, higher voltage drop, and loses torque. This condition increases the load on the power line—a serious matter where purchased power is used, and results in higher energy cost per unit of work done. The motors tend to overheat and damage windings due to excessive current set up by the high proportion of wattless current carried. This is one of the conditions which may be indicated by excessive motor temperatures, especially when a change in operating conditions has lowered the actual work done by the motor.

Inspections

Many companies now use an electrical-maintenance inspector in addition to the usual motor-maintenance crew. Others break up the maintenance crew and make inspectors of the men between specified or emergency shop operations periods. From being regarded as a sort of stepchild of the industry, to be stuck off in a corner and left to work until failure set in, the motor and its companion, the electric generator, now rank with the most highly regarded and most carefully kept up of all types of oil-field equipment. With the gradual drawing away of trained electrical maintenance men from the field operations by the armed forces, companies are making over their switchers and operating crew men into motor checkers who, if unable to correct potential motor failure, are able to detect signs of its impending occurrence, and thus to signal the trouble and permit its correction before serious damage can ensue.



The Stabilization of Crude Oil

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THE oil and refining industry has always prided itself on its technical alertness and the rapidity with which it adopts new and more economical methods. Very often, however, this pride is not justified, since the lapse in time before general acceptance of a well-known principle is usually great. The situation is analogous to the weather topic, about which much is said, but about which nothing is ever done. A case at point, is the field of rectification, or stabilization, of crude oil.

It is necessary, in this connection, to remember that the principles of natural-gasoline stabilization were fully known to the industry in 1923.[1] By 1928,[2] stabilization existed in gasoline plants in essentially the same form as is known today. Pressure-distillate stabilization in refineries was common by 1933. Field stabilization of crude oil, however, has not been accepted to the same degree, although the necessary tools have all been available. As an initial step in the study of why this condition prevails, it is interesting to "look at the record."

1926

One of the earliest public discussions[3] of crude-oil stabilization took place in 1926, at a meeting in Tulsa, sponsored by the then Secretary of Commerce, Herbert Hoover. At that time it was stated that the average volumetric loss for Mid-Continent oil from the well to the refinery was 6.3 percent. Of this loss, 1.8 percent tok place at the run-down tank, 0.5 percent in treating the oil, 0.5 percent while loading in tank cars, 2.5 percent in storage, and a final 1 percent in miscellaneous handling. The chairman of these meetings, H. B. Bernard, had this to say: "A matter of great interest is that of conservation of vapor from tank batteries on producing leases. We are going in the right direction, but in the present method we are not doing much more than pass the buck to the pipe lines, but this makes the industry suffer an economic loss." W. G. Heltzel adds the following: "Pipe line companies are now suffering a great percentage of the loss. The pipe line companies are using every known means to keep down evaporation losses, but we are limited. We have to transport products many miles. It would seem, therefore, that our thought must be directed back to the source of supply, in stabilization of the oil. This will offer a big opportunity in the future." The general consensus of opinion was that vapor tight tanks were necessary to reduce lease evaporation losses, and that the newly devised floating-roof tanks offered a solution. Instances were also cited where companies took off the lighter fractions of the crude in the field before transporting it, and it seemed to be the general impression that some such method would have to be

followed before evaporation losses could be reduced much below the existing average.

In 1926 it was also stated[4] that storage open to the air resulted in a total loss from the field to the refinery of from 4 to 5 percent. It was also advocated that any program to reduce evaporation losses from produced crude oil should be carried out throughout the entire system, or from the well to the refinery. It was argued that little advantage resulted in saving the wild gases from a 43°-API-gravity oil in field stock tanks when later it was pumped into 50, 80,000-barrel tanks subject to atmospheric pressure.

P. L. Gaurin[4] stated that some progress had been made along the line of stabilizing the crude oil prior to transportation to the refinery. The procedure advocated consisted of removing a cut of the lighter fractions by vaporizing at temperatures of 90-120° F. under vacuum conditions. The vapors so removed were compressed to a pressure of 40-60 pounds and cooled. The resulting condensate was then blended with the usual casinghead gasoline and transported by higher class vapor-tight facilities.

Anglo-Persian Oil Company installed such a system on an operation involving 34,000 barrels per day of 37°-gravity oil. The evaporation loss from the loading point to the refinery had previously averaged 3 percent, based upon a 3-year period. The process used consisted of passing the crude oil in the field through heat exchangers, thereby raising the temperature to 110° F. The heated crude then was admitted near the top of a tower filled with wooden grids, operating under a vacuum, resulting in 5 percent of the throughput being removed as a gas. This gas was compressed and cooled, and the resulting condensate introduced into the conventionally recovered natural gasoline.

The success of this installation caused Gaurin to conclude: "In the future, we may expect to see applications of crude-stabilizing processes in the United States by companies who produce, transport and refine their own crude production as a means of eliminating waste due to evaporation."

1927

In 1927, T. F. Smiley,[5] reiterated the statements of Gaurin. He called attention to use of the method in foreign fields, particularly where the evaporation losses were serious in transporting high-gravity oil long distances by tank car and pipe line. Emphasis was placed upon the fact that this so-called stabilization process was actually one of "topping," and hence familiar to all.

1929

In 1929 some very light crude oil was discovered in California which had to be transported through an existing pipe line originally designed to handle heavy oil. Attempts to pump this 61°-gravity oil with the installed machinery proved unsatisfactory and resulted in the recognition that the volatility of the oil was too high. As the project did not justify replacing of the pumping units, a so-called crude-oil stabilizer[6] was installed.

This unit consisted of three columns operated in parallel, each having a charging rate of 10,000 barrels per day. Crude oil from central gathering tanks was charged to the top plates of these columns which were held under a pressure of 5 pounds. Vapors leaving the columns were turned directly to the air. The liquid charge passed over 16 plates in each column to the bottom where heat was added by steam-heated kettles. The heating medium to the three kettles was exhaust steam from the compound crude-oil line pumps. Steam outlets from the kettles were connected to a wet vacuum pump which maintained the heating steam at 2-3 inches of mercury vacuum. Oil leaving the kettles was cooled and run to storage tanks from which the line pumps took suction.

These columns removed from 0.4 to 1.7 percent by volume of the raw crude oil and produced a pipe-line oil free of propane, which was readily handled by the existing pumping equipment. At the time, protests were made that the installation was incorrect in design, and that valuable pentane-plus fractions would be wasted in the overhead vent vapors. These criticisms were naturally verified by the actual operating results. The installation was probably justified as the terminal refinery at the time was not equipped to recover products lighter than iso-pentane, and existing pipe-line equipment could be used.

Also in 1929, a second major oil company in California gave serious consideration to a scheme[7] to stabilize light oil from the Kettleman Hills field. It was proposed to remove all iso-butane and lighter fractions, together with one-tenth part of the normal butane from the raw crude oil. This was to be accomplished by expanding the oil from the 450-pound trap through a second trap maintained at 175 pounds pressure. Oil from this latter trap was to be the feed to the stabilizer, which called for a bottom temperature of approximately 330° F., when operated at 145 pounds pressure. The rectified crude oil would then have had a vapor pressure at atmospheric temperature so that it could be handled in existing open tankage without material evaporation loss. Gas released from the two traps and the stabilizer was to have been treated in the conventional gasoline plant with a minimum loss of commercial gasoline fractions. Certain outside economic conditions arose which tabled this installation, but it was one of the few early proposals which will stand rigid analysis in view of present-day knowledge.

1930

In the following year, Indian Territory Illuminating Oil Company at Oklahoma City built a unique distillation unit[8, 9, 10] for the purpose of reducing abnormally high-gravity crude oil to pipe-line quality. This unit also processed drip-gasoline, and was located adjacent to one of the company's natural gasoline plants.

In this case, the management could not justify the 46-52°-gravity oil produced from a few wells being sold to the pipe-line companies at the posted price for 40°-gravity oil. Neither could they justify storing such oil because of the excessive evaporation losses. Likewise, the pipe-line companies were not desirous of handling such light oil because it was of no particular benefit to them. The company therefore decided to remove as motor fuel these troublesome light fractions, which could be distilled-off at relatively low temperatures, and to supply the pipe line with a so-called stabilized oil having a gravity range of 38 to 40° API.

In this operation, at 10 pounds pressure, approximately 30 percent of the raw crude charge was removed as a 66°-gravity motor fuel having an end point of 350° F., or, 390° F., as required by market demands. The gasoline was given a continuous hypochlorite treatment and blended with the correct por-

tion of natural gasoline to afford the necessary volatility.

This unit consisted of two columns operated in parallel with bottom heat of 350° F., supplied by internal steam coils. Uncondensed vapors from the overhead motor fuel were taken into the gasoline plant for recovery of valuable fractions. The topped crude oil from the columns was cooled to about 125° F., and run to storage from which it was delivered into the pipe line.

Wirt Franklin Corporation, also operating in the Oklahoma City field, was faced with a similar problem when the revised prices for crude oil eliminated gravities above 41° API. It likewise decided to install a rectification unit[11] for its 70°-gravity production. This equipment was installed in the gasoline plant at Trosper Park and was operated by the regular plant personnel.

This stabilizer unit was built of salvaged refinery material and consisted of a horizontal steam-heated still with an auxiliary fractionating column. Approximately 90 percent of the light oil charged to this still was taken overhead, agitation steam being used in the conventional manner. The overhead gasoline produced was usually about 70-72° API gravity with a recovery of 96-97 percent by Engler distillation. This gasoline was blended with still higher gravity, more volatile production from the natural-gasoline plant. The topped oil leaving the still was carried at, or near, 37° gravity, and was pumped into storage on the plant grounds where it was eventually mixed and blended with other raw lease productions to form pipe line oil.

This company also installed a second similar unit in its Lowery gasoline plant. The design and operation of this unit was practically identical with that of the Trosper Park plant.

C. K. Francis, in a written publication[12] in 1930, stated that the loss from evaporation was 3 percent, and that numerous systems were in use to reduce them. These were given as follows:

1. All metal tanks.
2. Insulated tanks.
3. Water top tanks.
4. Floating-roof tanks.
5. Gas holders.
6. Partial distillation, or stabilization, of the fresh crude oil.

The same writer stated[13] that the essential features of stabilization included removal of gas and the lighter fractions from the oil by means of suitable towers and heating at comparatively low temperatures. He in turn quoted Wilde as having stabilized crude oil before sending it to the conventional topping plant. This operation was conducted at 50 pounds pressure, a bottom-column temperature of 280° F., and a top temperature of 172° F. About 4 percent of the crude charge was taken overhead, with the liquefied portion being stored at 28 pounds pressure, and the uncondensed portion, or vapors, being processed in a natural-gasoline plant.

Anglo-Persian Oil Company also reported[14] that losses at its Abadan refinery had reached serious proportions. This location on the Persian Gulf was most unfavorable for oil storage, particularly since the oil received had been kept under positive pressure from the well-head through the pipe line. As a result, the oil carried a considerable volume of natural gas in solution, and this gas was actually utilized for fuel in the refinery. This pipe-line oil also contained casinghead gasoline recovered in field plants by the compression and absorption methods. Such gasoline represented about 3 percent, by volume, in addition to some 30 percent of straight-run gasoline contained in the original 39°-API-gravity crude oil.

During the summer season the crude would arrive at Abadan at 100° F., where the night temperatures are of the order of 80° F., and the noontide shade temperatures about 120° F. Sun temperatures of 175° F., are not uncommon. The evaporation and breathing losses occasioned by this great heat and wide temperature fluctuations can readily be appreciated.

About 25 percent of the oil received at Abadan was exported to Europe and the tankers carrying the oil necessarily passed down the Persian Gulf and the Red Sea, or, through one of the hottest regions on the globe. Obviously, no system of floating-roofs, gasometers, or gas bags at Abadan could prevent the exported crude from suffering very high losses during the process of transshipment.

The method finally installed to reduce these losses was extremely simple, the procedure being to remove the gas from the oil immediately when received. The gas evolved was stripped of its gasoline content and the latter stabilized, after which it could readily be held under pressure without notable loss. That portion of the gas-free crude which was later required for export was pumped to storage to await shipment. The remainder of the degassed crude went to the refinery as charging stock. The export oil was degassed to the least possible extent, or to about 2.5 percent by weight, in order to ship as volatile an oil as possible.

The plant as installed consisted of 6 deabsorbers, so-called because their function was the reverse of absorption. The crude oil received from the pipe line was heated by steam to 120° F., in summer, and 140° F., in winter, and introduced into the deabsorbers. These towers, operating in parallel, were held under 15 inches of vacuum by rotary vacuum engines which discharged the gases removed at 10 pounds pressure. The 10-pound gas was then two-staged in conventional reciprocating compressors to a final pressure of 50 pounds, cooled, and the resulting gasoline condensate removed. This condensate was then charged to a usual stabilizer unit. All of the uncondensed vapors from the cooling stage were processed for recovery of valuable fractions in an oil-absorption plant.

Each of the 6 towers handled 30,000 barrels per day of raw crude oil from which 35 to 60 cubic feet of gas was removed per barrel of charge stock. The resulting degassed crude processed in the refinery gave off but 3 to 4 cubic feet of gas per barrel of oil refined.

Other beneficial effects of the process were the saving in chemicals and the reduction in the degree of corrosion. The raw crude oil as received at Abadan was saturated with hydrogen sulphide to the extent of 0.6 pounds per barrel of oil. This oil resulted in the vent gas from the refinery condensers containing as much as 12 percent of hydrogen sulphide. When the refinery processed the degassed crude oil, these uncondensed vapors contained but 2 percent hydrogen sulphide, showing that the major portion of the H_2S was removed in the degassing operation. This reduction resulted in an appreciable saving in caustic soda in the subsequent treating operation.

Further credit was given the process for removing

all of the vapors formerly lost in storage and which never reached the refinery. The valuable fractions in these vapors became recoverable and were stabilizd. Such gasoline was blended with the straight-run product, yielding a larger quantity of motor iuel which had a high volatility and yet gave a distillation recovery of 97 percent.

And finally, the degassing operation was credited for materially reducing the fire risk so inevitably associated with the tankage of light crude oil when stored in such large quantities.

Also during 1930, the technical trade journals began to carry articles[15, 16, 17, 18, 19, 20, 21] dealing with the problems of oil and gas separators. It was pointed out that trap hookups were usually based upon considerations of precedent and custom rather than efficiency, and the very great need for abandoning such a wasteful procedure was emphasized. While these discussions did not specifically recognize the connection between the trapping operation and the rectification of crude, they did set forth certain fundamentals of separation which must be considered in any project involving the field stabilization of crude oil.

Among these was the fact that back-pressure on small wells could be alleviated by elevating the trap, permitting the separation of the oil and gas to take place at atmospheric or even lower pressure. It was further stated that vacuum separation was not necessary, and under certain conditions, even undesirable. The opinion was given, however, that where a company operated both the wells and gasoline plant, it was often a good move, since a more stable crude could be placed in the stock tanks while recovering all the gasoline from the gas.

It was also stated that other producers wanted the light gasoline fractions carried over in the oil to the stock tanks in anticipation of obtaining higher oil gravities for price reasons. The discussions emphasized, however, that a large differential pressure between the separator and the tank, together with agitation and temperature changes, often caused the reverse to be true. The consensus of opinion was that the industry, as a whole, would be subject to less waste if the gasoline plant received the richer gas.

Additional discussion pointed out that where natural gasoline was worth recovering, some form of gas lift, repressuring or booster operation was necessary. In these cases, failure to take advantage of the many thousands of horsepower furnished free in the high-pressure gas, made available by the use of high-pressure separators, was an inexcusable economic waste. It was concluded that in many cases a closer contact and more complete cooperation between the production and gasoline departments of the producing companies would result in a more efficient and satisfactory overall operation.

1931

In 1931, P. Magruder[22] published a very important paper dealing with double-trapping which was coming into vogue. His approach to the subject was scientific, with the conclusion that equilibrium conditions between the oil and gas seldom existed in the surface separators or traps. It was pointed out that this was particularly true at high pressures and large rates of flow. He further concluded that equilibrium conditions were more nearly approached in the secondary traps when operated at pressures of 65 pounds or lower.

Magruder further discussed the performance of the atmospheric trap and tank-vapor-recovery system. He showed that they were equal with the exception that none of the displacement and filling loss could be recovered by the trap. This loss was stated to vary from 0.1 to 0.27 percent of the volume of the crude oil handled. In the case of small pumping wells he advocated that the oil and gas could advantageously be turned directly to the vapor-recovery-equipped lease tanks.

The results of these various studies showed that the greatest economy could be affected by utilizing natural well pressure to the greatest possible extent in the disposal of gas. This applied to all gas, including that delivered to the gasoline plant. It was emphasized that particularly large savings were possible where companies could make the gas available to their own gasoline plants at pressures in the range of 150 to 300 pounds.

1932

Thought in 1932 was further directed toward controlling crude oil gravity and preparing it for pipeline shipment.[23] For the practical solution of the problem it was considered necessary to wholly remove the troublesome impurities and wasteful fractions on the lease, or before the crude was delivered to the pipe-line company.

In continuing, it was pointd out that while production would continue to be discovered, an increasing proportion of the flush oil would come from horizons deemed wholly impractical in earlier drilling. Crude oil from these deeper sands would contain a greater volume of dissolved gases, and with the higher pressures, the problem of "cut" oil could be expected to be much greater. To prepare such oil for pipe-line acceptance, it was stated that it would be necessary to:

1. Eliminate the dissolved gas.
2. Remove water, asphaltic precipitations and colloidal earths.
3. Restore waxes to complete solution.
4. Recover the low-boiling gasoline fractions.

It was stated that many of these operations were being carried out under more or less casual and unrelated circumstances in three or four separate processes. For example, dehydration, degasification, vapor recovery, and recovery of "tank bottoms." The criticism was made that such operations were often conducted in the wholly mistaken belief that all of the gasoline fractions from the well must necessarily be crowded back into the crude oil from which they strenuously endeavor to escape. It was further suggested that it would be far more economical if all of these functions could be carried out in a single unit under controlled conditions upon the lease.

Buck then advanced a scheme for combining dehydration, degassing, stripping, and stabilization of the crude oil in a single unit. First, chemicals would be added to the oil as it left the trap in order to free the crude of as much water as possible before entering the unit. The raw crude would then pass through a heat exchanger where heat would be extracted from the already processed oil, cooling the latter sufficiently for either pipe-line delivery or storage. The now heated raw oil would flow upward through a wash tank where it would be washed through several feet of water maintained at about 200° F., by means of steam coils. This operation was

designed to free the waxes and remove asphaltic precipitates and colloidal earths so as to rid the oil of any residual emulsion. The washed oil was then to flow through a steam-heated preheater which increased its temperature to about 260° F., or more before entering a stripping column which essentially was to be a bubble-plate still. A fractionating column located above the stripping column was to receive reflux and provide control over the overhead product. Side streams provided means of taking off heavier cuts of a gravity suitable to blend with the product from a natural-gasoline plant to make a finished motor fuel. The lower portion of the stripping column was provided with steam heating coils and means for the injection of live steam into the processed oil. The control of temperatures in the preheater and bottom steam coil, together with the quantity of reflux, furnished a means to take off such fractions as would make the finished bottom oil uniform in gravity. Uncondensed overhead vapors were designed to be processed in the gasoline plant, making the proposed method of treatment one in which no desirable products in the vapors would be lost.

In the same year, the writer stated in a published paper,[24] that, "by fractionating out of the crude these undesirable fractions ahead of the still battery, a very stable straight-run product is obtained which can be economically handled throughout the remainder of the refining process." In a second article,[25] this statement was made, "In cases where the refinery is operated on light crudes, consideration should be given the addition of a crude-oil stabilizer to the recovery system."

Still later in 1932, C. A. Russell,[26] said that by removing from the crude those undesirable constituents, material savings could be effected throughout the refining process. Complete control of the entire refinery operation was to be obtained by prestabilization of crude before fractionating it in the regular distillation units. The benefits from such treatment were listed as follows:

1. Water, water soluble salts, and sediment will be removed.
2. Corrosive gases are removed which will increase the life of tanks and other equipment.
3. Treating costs of straight-run gasoline will be materially reduced.
4. The preremoval of some of the lighter gasoline fractions will reduce the piping costs of the vapor-recovery system.
5. Vapor losses from storage tanks will be eliminated.
6. The fire risks from the stored crude will be reduced.
7. Prestabilization permits better control of vapor pressure and distillation curve of the refinery straight-run gasoline.

Humble Oil & Refining Company installed a system[27] for the control of gasoline volatility and evaporation losses. The essential feature of the plan developed for accomplishing this was not to fractionate the raw crude, but to stabilize the light fractions as they were produced from the oil. This plan resulted in the bulk of the naphthas being sufficiently stable to prevent vapor losses on further processing, and permitted the handling of the segregated volatile fractions in specialized equipment. After the light fractions were stabilized in this manner, they were blended back into the naphtha to form the finished gasoline.

The system as operated consisted of running the naphtha stream hot and venting it before reaching the final coolers in the receiving house. Vapors removed in this way, together with those taken from the run tanks, were passed to the suction of a compressor. Residue vapors after this compression to 35 pounds pressure, with subsequent cooling, were then treated in the absorption plant. The condensate from the compression operation, together with the production from the gasoline plant, was then jointly stabilized at 230 pounds, and the resulting product used as a blending agent in the final refinery product.

The advantages set forth for this system were three, and are as follows:

1. When the greater proportion of the more volatile fractions are removed from the naphtha, the latter is stable and can be handled through subsequent operations of treating and rerunning with the minimum vapor evolution.
2. Propane, which is undesirable in the final finished motor fuel, is substantially removed from the naphtha by this treatment.
3. As the last few degrees of cooling on naphtha streams are always the most difficult to obtain, the maintenance of higher stream temperatures effect a material saving in water consumption.

Another plant,[28, 29, 30, 31] originally conceived in 1930 but first operated in 1933, was that of Compagnie Francaise de Raffinage, located near La Havre. The management in this case was faced with designing a 16,000-barrel refinery for ultimate operation late in 1934 on Iraq crude from the terminals at Haifa and Tripoli. Initial operation, however, required that oil from East Texas, Peru, Ecuador, and Grozny be processed. One of the major problems faced by the designers of the installation was to handle this variety of crude oil as it arrived from foreign fields with minimum loss. The ultimate, and very sound decision reached, was to provide facilities so that the oil, as received, could be made suitable for storage over a long period, thereby permitting subsequent refining without undue evaporation or other loss. This feature is claimed for the predistilling plant, the use of which does not interfere with normal oil refining operations.

In selecting the installation of a predistilling plant the management investigated what had previously been accomplished in relation to handling crude oil prior to storage or distillation. Consideration was given equipment used for the separation of suspended matter, for treatment of emulsion, and for the removal of dissolved hydrogen.[14] Also, the questions of conserving the lightest fraction in the oil,[32] of combating corrosion, of improving the safety of plant operation, and of reducing distillation losses,[27] were carefully studied. Special attention was given the storage of oil in gas-tight tanks of special design,[33, 34, 35] and the recovery of gasoline from refinery vapors.[36, 37] The result of this investigation was the predistillation plant, which combined many necessary functions in a single unit, and the application of which offers many advantages to other refiners.

When fresh crude oil arrives at this refinery, it is sent through heat exchangers and into pressure settling chambers at a temperature of 239° F. Water and suspended matter settle out from the oil at this stage and are drained into the sewage system. The dehydrated oil continues on through a pipe still, where its temperature is raised to 284° F., and into a fractionating column operated under a pressure of 71 pounds. Sulphureted hydrogen and the more volatile

hydrocarbons are taken overhead in this column, resulting in a bottom product oil having a very low vapor pressure. This stabilized residue then gives up its heat in an exchanger and passes to storage. After this preliminary treatment the oil is handled through the conventional refinery channels in the usual manner.

The light overhead vapors from the column are compressed to 242 pounds and cooled. Condensate resulting from this operation is given a caustic treatment and stabilized in the conventional fashion into a light gasoline of controlled vapor pressure. This product is then plumbite treated and stored under pressure where it becomes available as a blending medium in the refinery proper.

The vapors vented from this stabilizer column are condensed and form a liquified petroleum gas. Uncondensed vapors are consumed for refinery fuel, and the hydrogen sulphide which they contain is thus conveniently eliminated.

It is interesting to note that when this predistilling plant processes Iraq oil, about 7 percent of the throughput is removed in order to produce the required stabilized oil. Also, that approximately 5 percent of the charge is segregated as a highly stabilized light blending gasoline for refinery use.

One important advantage gained by the installation of this predistilling unit was that the capital investment for erecting the new refinery was lowered. This is due chiefly to the fact that the tanks for the storage of crude oil and straight-run gasoline need not be equipped with floating-roofs, breather bags or other special vent fittings. Vapor gathering lines from these tanks and a gasoline recovery plant were not required, and hence their cost was saved.

Losses of light gasoline products due to weathering, pumping and storage transfer are, at the same time, almost entirely eliminated by reason of earlier stabilization.

As crude oil from Iraq contains much dissolved H_2S, further losses due to corrosion of equipment are eliminated because of the manner of removing this troublesome factor by the predistilling plant. Thus the maintenance charges for the tank farm, pipe lines and refinery equipment are in every respect, normal.

Savings likewise follow in the quantities of chemicals required in the treating operations and on account of fewer shutdowns of equipment for cleaning and repair work. Safety of operation and plant equipment is also increased as a result of the above advantages.

Still further advantage is that the refinery becomes more or less independent of climatic conditions, since very cold cooling water is no longer essential to recover all of the valuable and desirable gasoline fractions. This results from the fact that the lightest ends are taken off the fresh crude and condensers and are handled at high pressures throughout the remainder of the refining process.

It is stated that the predistilling plant will, within a relatively short period, pay its cost out of savings in refinery operations and losses, not taking into account the lowered cost of capital investment for constructing the refinery.

1934

In 1934, The Texas Company[38] built a very interesting plant at Crowell, Texas. The wells of this field are located in a pool of 48°-API-gravity oil, with formation pressures of the order of 1300 pounds. The gas volumes are large, and the allowed amount of oil and gas are produced with 900 pounds carried as back pressure on the tubing head controls. When this oil is run to open flow tanks at atmospheric pressure and temperature, considerable weathering takes place, accompanied by a serious shinkage in volume. To overcome these losses and to recover the natural gasoline, a combination crude oil stabilizer and gasoline recovery plant was installed.

A central location was selected at which to erect the oil and gas separators, crude-oil stabilizer and gasoline-recovery unit, based upon the knowledge of the oil-producing structure. Two-inch flow lines were installed from the well controls to a common separator, which was selected with ample size for additional well completions. The oil and gas entered this separator which was maintained at 600 pounds pressure, and at which point most of the so-called fixed gas was released. The reduction in pressure from that carried at the well heads produced a refrigeration effect on the oil, so that the gas released at the trap could economically be used for fuel.

The oil from the primary trap flowed to a second trap operated at 350 pounds pressure, and then into a surge tank held at 30 pounds. These stage reductions in pressure lowered the oil temperature to about 42° F. Oil from the surge tank passed through a heat exchanger and into an evaporator column at a temperature of 150° F. This topping or stabilizer column was provided with a reboiler which maintained the base temperature at about 225° F. The top of the column was equipped with a condenser and conventional reflex accumulator. Under these conditions a stabilized crude oil was obtained which had a gravity not lower than 42° API, and which was stable enough to handle in the storage tanks without loss.

Uncondensed vapors from the reflux accumulator and surge tank are compressed and mixed with the vapors vented from the second trap. These combined vapors, together with excess liquid from the reflux accumulator, are then introduced into a second stabilizer unit. This unit fractionates the combined vapors and excess reflux so as to produce as a bottom product any grade of natural gasoline as required by market conditions. This product generally averaged about 82° in gravity with a Reid vapor pressure of about 18 pounds. Rejected overhead vapors from this second stabilizer were utilized as fuel.

When desired, the crude stabilizer and vapor recovery stabilizer can be operated separately. As the leases are all held by The Texas Company, arrangements made between the production and gasoline departments can be easily carried out to a successful conclusion.

In 1934, C. K. Francis[39] referred to certain practices[8, 14] previously carried out. In both these instances, the raw crude oil was topped to avoid large weathering losses. He pointed out that these oils were of exceptional quality, and contained much more than the average quantity of gasoline. Because of the large production of crude oil in recent years in the United States, it has not been necessary, or advisable, for the major purchases to place large volumes of oil in storage where excessive losses take place. The greater portion of this production is not light enough to suffer great losses for the short periods it must remain in storage before being shipped. He concluded, however, that where it is known that a light oil is to remain in storage for some time, it is an excellent idea to stabilize it in the field.

Another paper[40] pointed out that large sums of money had been expended during the previous 15 years with the view of reducing losses of volatile constituents of crude oil before refining. At the same time, efforts had been made to reduce corrosion of storage equipment due to hydrogen sulphide. It continued by saying, that it "now recognized that prestabilization of the crude will accomplish these results, and in addition, at no additional cost for fuel oil, salt, and b.s., can be practically eliminated." It was also pointed out that elimination of hydrogen sulphide was an important item when it was realized that this gas caused the loss of volatile hydrocarbons when it left the crude due to its high vapor pressure. The losses entailed by corrosion from this gas were shown to be large, and in some instances, the hazard of explosion in the tanks was increased. The removal of b.s., and salt prior to distillation of the oil had a greater beneficial effect because it permitted smoother control of the fractionating equipment, a fact not generally recognized. The paper further showed that the major benefit of prestabilization of crude oil was reflected in the construction costs for new refinery equipment due to lower costs for crude storage, and the fact that vapor recovery plants were unnecessary for gathering vapors from these storage tanks. Where the prestabilization of crude was practiced in a refinery, the latter became less susceptible to climatic changes and warmer water for cooling purposes could be tolerated.

The authors then proceeded to point out the one obstacle to prestabilization of crude oil in the field, pointing out that it was one which was not technical, but legal. They stated that present laws and regulations were such that the separated gasoline at the stabilizer, as well as the crude, took higher transportation rates to the refinery than the original crude oil. It was concluded that these regulations and laws should be changed if the industry was to benefit from this development and if the natural resources of the country were to be conserved to the highest degree.

1935

In 1935, Compagnie Francaise de Raffinage[41] started operation at a new refinery located on the Mediterranean, near Marseille. This refinery was especially designed to secure maximum efficiency when producing light oil products from Iraq crude. The plant has a capacity of 9000 barrels per day with the crude distillation carried out in three stages. The first stage is a prestabilization operation in which the crude is freed of fixed gases, hydrogen sulphide and the lightest oil fractions. The remaining two stages are atmospheric and vacuum distillations.

In the same year, interest was again displayed in the stage separation of crude oil and gas.[42] As pressures on the separators were increased it was found that considerable quantities of gasoline went into solution in the crude oil, a large part of which evaporated when the oil was run into atmospheric storage tanks. Contrary to the then common belief, the crude oil produced by this method proved to be of higher gravity than the oil which flowed directly from the well to the storage tanks. High-pressure stage separation was further accepted by natural gasoline manufacturers since they realized they could materially reduce their investment in gas-gathering lines and compressor equipment by utilizing the higher back pressures available at the flowing wells.

Stage separation was also shown to go a long way in solving the problem of entrainment since crude oil has a tendency to foam under reduced pressures. By releasing the greater part of the gas at the higher pressures, the entrainmnet difficulties were invariably reduced in the low-pressure separators. The entrainment of crude oil into the gas line represents not only a loss to the oil producer, but creates a nuisance for the gasoline manufacturer, who must drain it from his gas lines in order to prevent contamination of the absorption oil.

J. S. Carey,[43] in 1935, stated that in some instances. the first distillation operation on a crude oil, either at its source or in the refinery, is stabilization. Where this operation is carried out it generally consists of the complete removal of all light hydrocarbons through the butanes, together with portions of the pentanes and hexanes. The major results achieved by crude stabilization are given as follows:

1. There is a decreased vapor loss from the oil in storage and hence a minimum load to the refinery vapor-recovery system from the storage tanks.
2. Hydrogen sulphide is eliminated with consequent diminished corrosion to tankage and distillation equipment.
3. A stable straight-run gasoline is recovered in the refinery with consequent reduction in vapor losses in handling this product.
4. A settling operation under temperature and pressure can be conveniently combined with crude oil stabilization, thereby permitting "bottom sediment" and water to be removed at the same time.

The stabilization of crude oil can be conducted in the field, the refinery, or at some intermediate bulk storage point. Field stabilization would appear to have certain economic advantages, especially from the standpoint of conservation. Field stabilization can be combined with the field gas-recovery system, resulting in three major raw materials as follows:

1. Stabilized crude oil.
2. Stabilized natural gasoline, as recovered from the natural gas and the crude oil.
3. Dry natural gas suitable for fuel purposes.

The chief obstacle to field stabilization is that the separated natural gasoline, as well as the stabilized crude oil, must bear higher transportation rates to the refinery than the original crude oil. In some cases, however, import and transportation regulations are such that natural gasoline as recovered in the field is blended with the raw crude before transportation to the refinery. A crude stabilization operation at the refinery then becomes both a technical and economic necessity.

A proposed plant designed to stabilize a crude oil blend containing 5 percent by volume of unstabilized raw natural gasoline is described. This plant is very elaborate since it provides means for the further separation of the lighter fractions into ethane and lighter fractions, commercial propane, commercial butane and stabilized light gasoline. The system further provides for the preheated crude to be settled under pressure and temperature for purposes of dehydration prior to introduction into the stabilizer column operated at 75 pounds pressure. It is stated that stripping of the crude bottoms in this column will be aided by open steam injection at the base of the tower. The overhead vapors from the column pass through a condenser for the production of reflux which is returned to the column, while the net yield of condensate is given a caustic-soda wash for removal of hydrogen sulphide. This condensate then

serves as the feed to a second column for recovery of the several fractionated products.

1936

By 1936, stabilization of crude before delivery to pipe lines was not novel, but had not been previously attempted upon a scale as practiced by Iraq Pipe Line Company.[44, 45, 46, 47] This plant was authorized in May, 1935, and the first processed oil was delivered to the pipe line at the end of September, 1936.

The plant was installed at Kirkuk, Iraq, for the purpose of stabilizing the field production of approximately 80,000 barrels per day. Pressure crude oil, direct from the first-stage oil-and-gas separator, is charged to the plant. After elimination of undesirable light fractions and H_2S in the crude, the stabilized oil is delivered to a tank farm at the first pipe line pump station.

Production of the Kirkuk field is carried to the Mediterranean through a double pipe line, one branch 532 miles long, terminating at Tripoli in Lebanon, and the other branch, 620 miles long, terminating at Haifa in Palestine. The bulk of the oil passed through these lines goes by tanker to the various European refineries. One of the reasons for stabilizing the oil at Kirkuk was to prepare it for this vast transportation system and to thereby save the heavy evaporation losses which were occurring.

The other reasons for justifying the stabilizer unit resulted from the fact that Kirkuk oil contains 2 percent of hydrogen sulphide. This caused a heavy sulphurous corrosive action on pumps, pipe lines, tankers, and refinery storage tanks, and presented a continuous and expensive maintenance item. Furthermore, refineries located in or near European cities operating on this oil were the objects of much criticism due to offensive odors liberated in refining and treating operations.

As a matter of interest, completion of the Kirkuk stabilizer plant was timely since it averted disruption of normal movement from this source. Just prior to placing the stabilizer unit in service, the municipal authorities of Havre, France, withdrew permission to operate pipe lines from the port to refineries on the mainland. This action culminated months of arguments over the question of eliminating offensive and objectionable gases from Havre. It was contended that the high sulphur content of Iraq oil produced the offensive odors both by evaporation of the more volatile ends from the oil in storage and in the refining process.

The bulk of this criticism was directed at Cie Francaise des Petroles, French subsidiary of Iraq Petroleum Company, which operated chiefly on Iraq crude. This company attempted to overcome the objections by injection of caustic soda in each tanker loaded at Tripoli. The Havre officials revoked the company's pipe-line permit when a cargo of Iraq oil arrived, supposedly without adequate treatment for removal and neutralization of the sulphur, and was moved to the refinery. With the arrival shortly after this of stabilized crude, all objections of the municipal officials vanished, and the pipe line was released for operation again.

The Kirkuk field employs the central-separator system for groups of wells. Three such stations have been installed, each equipped for two-stage, or, if required, single-stage separation. The wells have individual flow lines to their respective separators, the sizes varying from 4 to 8 inches, being governed by the length of life and volume required or available. The longest of such flow lines is about two miles and the shortest possibly one quarter mile. With this production system it was recognized that the oil delivered to the first pipe line pumping station would be "wild."

Gas analyses at various pressures of separation were made as a guide to a possible scheme of gas processing. It was also realized that while normal method would be satisfactory from a gas processing point of view, the distance of the field from seaboard precluded the possibility of a separate line. It would therefore be necessary for the product recovered from the gas to be returned to the crude oil, itself unstable, thus creating an unsatisfactory condition.

Again, as the gas contained a fairly high percentage of hydrogen sulphide, an investigation was made to ascertain the possibility of combining gas processing and sulphur elimination in a single operation. The conclusion reached was that the only possible means of eliminating the undesirable gases and fractions, while at the same time retaining the valuable hydrocarbons, was through efficient fractionation.

The stabilization plant as actually built was designed in three 40,000-barrel units, making it possible for any two to handle the throughput with one unit in reserve. Each unit in turn is identical with the others, so that all parts are interchangeable. The initial design called for the plant to eliminate from the oil all H_2S, methane, ethane, and practically all propane and a proportion of the butanes.

The method of operation of one of the units involves processing in two stages. Essentially the first stage secures the elimination of the undesirable constituents, effects a light topping of the crude and the partial fractionation of the light distillate. The second stage fractionates the light distillate and the vent gas from the first stage. The resulting stabilized light distillate is blended with the topped oil from the first stage to produce the stabilized pipe-line oil. Undesired constituents, in gaseous form, are vented from the second stage and used as fuel, the excess being burned as a flare.

Gas from the first high-pressure trap is led away and burned since it contains little gasoline. The oil from this trap is then flashed at 50 pounds in the second trap, and the relatively small amount of gas released is used for plant fuel. The oil is pumped from the second trap to a preflash column, the vapors so released are also used as fuel. The purpose of this preflashing is to insure a charge to the stabilizer of essentially constant composition by taking crude of varying composition and subjecting it to venting under constant pressure and temperature conditions.

The stabilizer column proper is operated at 100 pounds pressures. Heat is supplied to the base by means of a tube still through which a portion of the bottoms are recirculated. The overhead product from this first column is condensed and forms the liquid feed to the second column. Uncondensed vapors are compressed and also introuced into the final stabilizer column along with the liquid feed. Heat required by the second column is supplied from the stabilized oil leaving the first column.

In 1936, R. L. Huntington[48] stated that stage separation is a process in which mixtures of crude oil and gas flowing from producing wells are separated into liquid and vapor phases by two or more equilibrium flashes at consecutively lower pressures. The ideal method would be that of true differential liberation of gas, or by the steady decrease of pressure

from that existing at the well head to the atmospheric storage tank. This method will retain maximum amount of gasoline in the crude oil.

To carry out such a differential process is impractical. An approach to it is desirable, and can be accomplished by putting the mixtures of oil and gas through several separators in each of which flash vaporization takes place. This will result in the maximum economical amount of gasoline being retained in the oil. However, after the second stage, very little advantage is gained by additional stages in so far as the retention of gasoline in the oil is concerned.

If natural gasoline is worth more when it is dissolved in the crude oil, then it is only logical that stage separation should follow. If natural gasoline is worth more when it is separated as such after taking into consideration cost of manufacture, the producing method which yields the greatest amount of gasoline in the gas should be adopted. At the same time, the oil producer must work with the pipe-line company and the refinery. The more volatile crude oils suffer heavy evaporation loss while in transit and storage at the refinery. Therefore it is not always economical to attempt to raise the gravity of oil merely for sake of increasing its volume and raising the price per barrel.

The natural-gasoline industry has already realized the advantages of stabilizing its gasoline before shipment and the fact that such operation actually results in an increase in production. In the same way it is predicted that both the producer of crude oil and the pipe-line company will realize the advantages of stabilized crude oil as a means of reducing evaporating losses in storage and transportation.

Just how fast the industry will take up stabilization of crude oil is difficult to determine. It has already invested millions of dollars in vapor-saving devices for large storage tanks so that stabilization is not so greatly needed had these investments not been made. There is no doubt but that stabilization would result in a lower production of pentanes and heavier fractions in the gasoline plant, as these constituents would be retained to a greater extent in the crude oil. Since gasoline plants recover most of their production from field separators operating under 5-pounds pressure or less, the effect of stabilization would not be very great so long as the wells were produced by the conventional methods.

Stabilization of crude oil would call for large investments in fractionating towers and would add to lease operating costs. It is unlikely, therefore, that the fractionation of crude in the field is apt to take place soon except on leases producing large quantities of high-gravity volatile oil, or in those districts where the oil is likely to be subjected to long periods of storage under hot weather conditions.

Disadvantages of stage separation for natural-gasoline manufacture are that both high- and low-pressure gathering systems are necessary in order to process the gas products from the separators. Although the gas volumes for low-pressure separators are usually so small that it is not economical to process them in a low-pressure gas-gathering system, they can not generally be disregarded on account of their high gasoline content. The use of stage separation does tend to decrease the amount of natural gasoline produced per barrel of oil since the approach toward differential liberation of gas tends to hold a higher percentage of the gasoline in the crude oil.

(To be continued)

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A Simple Apparatus for Small Scale Catalytic Hydrogenation*

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NUMEROUS designs of apparatus for small-scale catalytic hydrogenation have been described in the literature, a good survey of which has been given recently by Johns and Seiferle[1]. While no claim is made for great originality in the apparatus now described, the authors believe that they have combined the good features of several types of apparatus and modified them to give one which is very simple in construction and operation (Figure 1).

One of the inconveniences of most designs is the shaking mechanism, which usually is of the reciprocating type. Weygand and Werner[2] used an electromagnetic stirrer. The authors have substituted a medium-size Alnico permanent magnet for the electromagnet, and in place of the complicated devices for introducing the sample or catalyst have used a cup and stopcock. The type of buret used by Johns and Seiferle[1] has been retained, since this avoids the use of a stopcock.

As usually operated, the weighed sample to be hydrogenated is placed in the flask with a suitable solvent and the iron-cored stirrer. With the stopcock open, the flask is connected to the buret by the ground joint and held in place with a buret clamp. The reservoir is lowered, the height of the magnet is adjusted, the stirrer is started, and the speed of the motor is regulated so that good stirring is obtained without throwing the liquid too high up the side of the flask or causing the magnet to lose the stirrer. The apparatus is swept out with hydrogen which has been saturated with the solvent used in the flask by bubbling through a wash bottle having a fritted-glass distributor. The confining liquid in the reservoir may be either mercury or solvent.

After the air has been swept out, the desired amount of hydrogen is trapped in the buret, the stopcock on the flask is closed, and stirring is continued until the volume of hydrogen as read on the buret no longer changes, at which time the stirring is stopped and the temperature and barometric pressure are noted.

After slightly reducing the pressure in the flask by lowering the reservoir, the platinum oxide or palladium oxide catalyst is introduced by the following procedure: The catalyst is weighed into a narrow glass or metal scoop and a measured volume of solvent, usually 5 cc., is drawn into a pipet. A few drops of solvent are run into the cup, the catalyst is added, and the scoop is washed with a few more drops of solvent. The catalyst is then drawn in through the stopcock and washed in with the remainder of the solvent, care being taken not to admit air. This procedure has the advantage of permitting reduction of the oxide catalyst in the presence of the compound to be reduced, which gives a more active catalyst than reduction in solvent alone. It was not found possible to have the catalyst present while the apparatus is being swept out with hydrogen, because the rate of solution and diffusion of hydrogen is so great that hydrogen is absorbed at the rate of about 0.5 cc. per minute even without stirring.

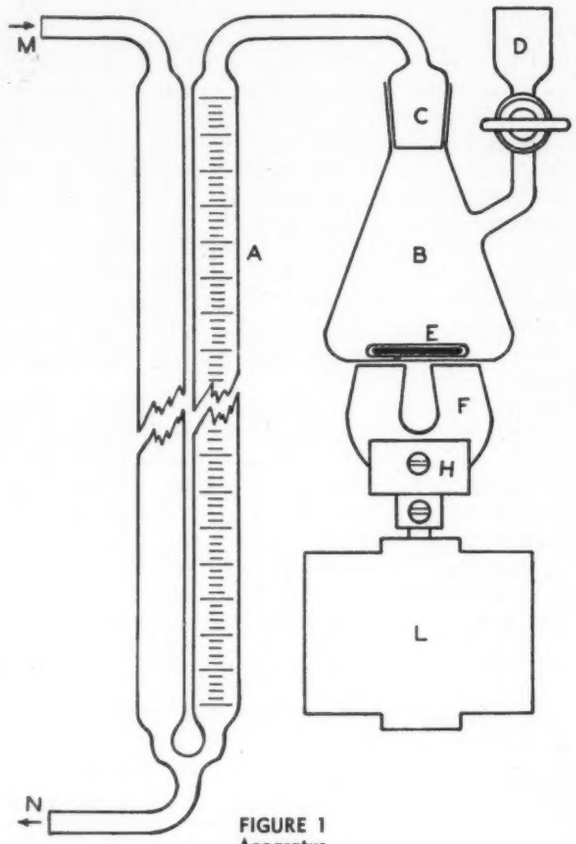

FIGURE 1
Apparatus

A. 50-cc. buret.
B. 50-cc. flask.
C. 19/38 interchangeable ground joint.
D. 5-cc. cup.
E. 2-cm. section of 8 d. nail sealed in glass tubing.
F. Medium size Alnico magnet.
H. Brass saddle with setscrews.
L. 1/100 h. p. variable-speed motor.
M. Hydrogen inlet.
N. To reservoir for confining liquid.

After addition of the catalyst, stirring is started and continued until hydrogenation is complete, when the volume, barometric pressure, and temperature are read again. The volume of the catalyst and wash solvent and the hydrogen absorbed by the catalyst and solvent are determined in a blank run.

While this apparatus has been used only for semimicro work and not for measuring the volume of hydrogen absorbed with great accuracy, there seems to be no reason why it cannot be adapted to micro work or why it should not yield results as accurate as most other forms of apparatus, if the corrections and calculations described by Johns and Seiferle[1] are applied.

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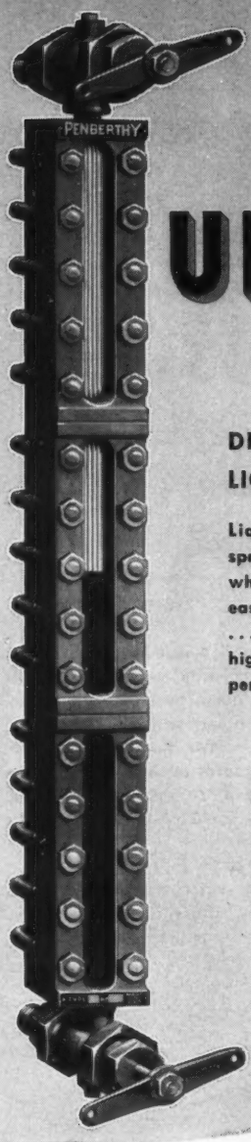
[1] Johns, I. B., and Seiferle, E. J., IND. ENG. CHEM., ANAL. ED., **13**, 840 (1941).
[2] Weygand, C., and Werner, A., *J. prakt. Chem.*, **149**, 330 (1937).

* Reprinted from Industrial and Engineering Chemistry, Industrial Edition, November, 1942.



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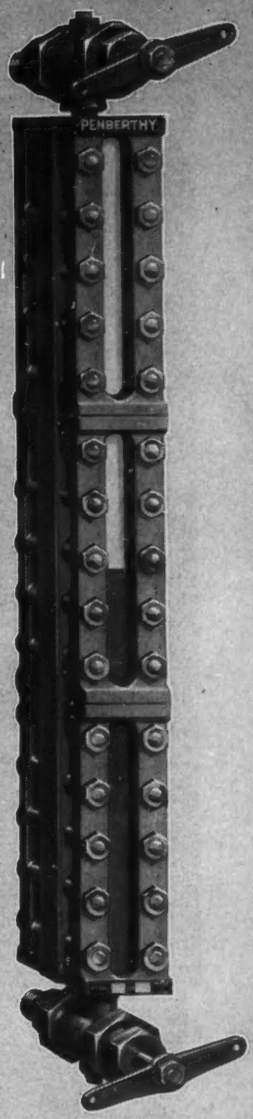

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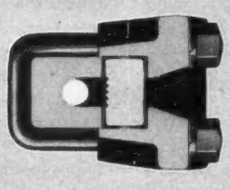

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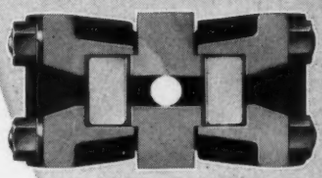
Used to observe color and density of liquids under high pressures, and/or temperatures. Construction is exceptionally rugged . . . similar to Reflex types.



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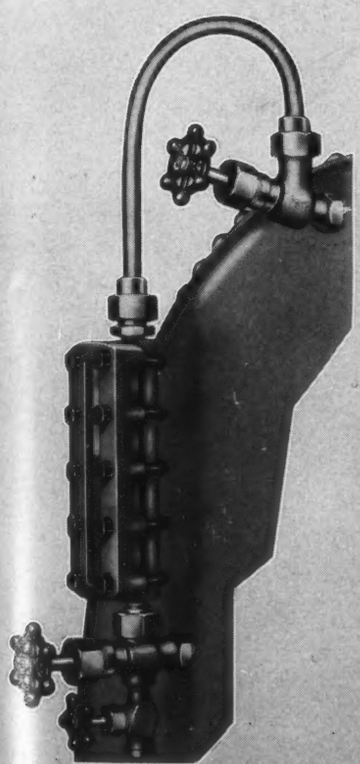

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Water shows black—steam shows white. U-bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler.

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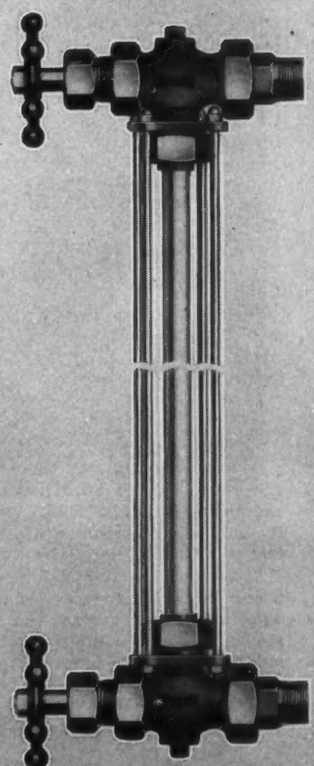

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PENBERTHY PRODUCTS

Here "Lady" a member of the canine guard at the Ponca City plant of Continental Oil Company is going through part of her training under the supervision of Floyd Story, chief patrol officer. For working night patrol with the armed guards each dog must know how to heel, to stand, to respond to "come on" or "come at" commands, how to attack the saboteur, how the hold the prowler until master and other guards arrive.

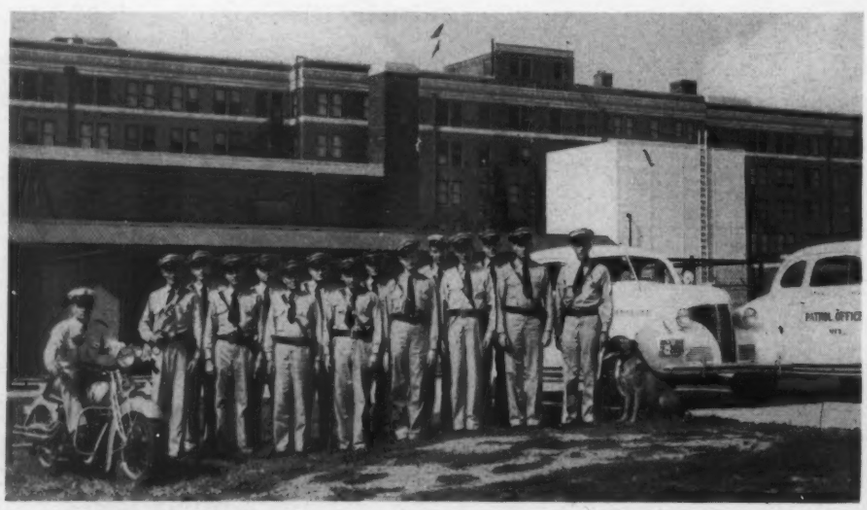
The Bullmastiff came to be the dog for service in Continental Oil Company plants because Dan Moran, company president, who had privately trained and developed this breed for his personal use.

Men and Dogs Guard Continental Plants

IT'S a man and a dog for night guard duty in refining plants of Continental Oil Company. The dogs, the English bullmastiff, now are being trained at the Ponca City plant, where the kennels are maintained. These powerful animals, descendants of the huge mastiff of the Roman invasion era, are a favorite of Dan Moran, president of the company, who imported the stock from which the guard dogs have been selected.

The dogs round out a protection program which includes the gate watchmen as well as the armed patrol. The program includes thorough training of men and dogs and painstaking adherence to regulations. The description of the guard program and what it involves was taken from the December, 1942, issue of "The Red Triangle," official publication of the company. Novelty of the addition of dogs to the patrol resulted in prominence being given their part in the program.

"At nightfall the dogs go on duty at various patrol stations, each with an armed guard. Nineteen guards make up the patrol at the Ponca City refinery. Before a man is selected he is investi-



The armed patrol at the Ponca City plant consists of 19 men. Its activities are under the supervision of Joe S. Boylan, superintendent of the safety and sanitation division. Concerning the men information from the company is:

"The Continental guard is all man. He is 5 feet, 11 inches tall, weighs 180 pounds, despite his 40-year average age he is agile and strong. He learns discipline and order by doing military drill in the company's own gymnasium. An officer of the United States Provost Marshal's office periodically inspects this training to see that it is properly done."

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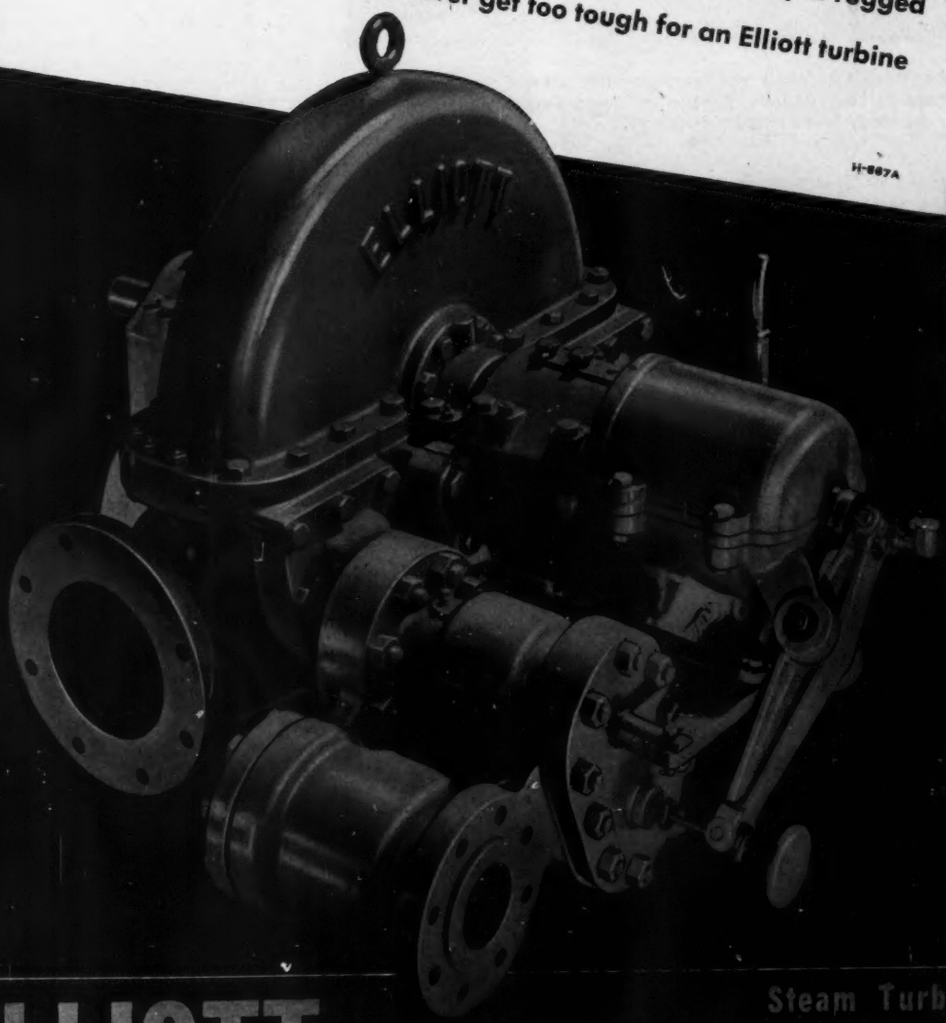

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The Bullmastiff kennels at the Ponca City plant will breed dogs for other Continental plants. Already dogs have been assigned to Lake Charles, Wichita Falls and Denver. Others soon will be ready to go on duty elsewhere.

gated by the Federal Bureau of Investigation.

"The training of a guard is thorough. He learns to fire a pistol accurately, how to handle the sub-machine gun and becomes effective in disarmament and defense methods both with and without the aid of his bullmastiff. Each guard must take the oath of allegiance to the United States. When training is complete he is commissioned a deputy sheriff.

"Assisting the armed guards in the company's alert watch over its property and personnel is a third group . . . the gate watchmen.

"Thrills may not be as plentiful for the gatemen. They do not have a dog for a watch companion. Theirs is the job of stopping the bolder fifth columnist who would attempt to march through plant gates with our own industrial soldiers. Fifteen watchmen are ready for any such invader. No one passes them without complete identification.

"All trucks or other vehicles entering plant gates are inspected and their contents checked. Nothing is above suspicion. Refinery visitors are few and far between during these war times. Even those who are permitted to enter are investigated before passes are issued. Those not actually employed by the company must be accompanied by armed guards, even though they may be on bona fide business missions.

"Primary training of the bullmastiffs in Continental Oil Company's service was conducted by Harry Schoonover, Houston, a man with many years of experience in the training of circus animals. Basic and advanced training is carried on by Floyd Story, chief patrol officer, and a veteran police officer who has had much success in training dogs for guard duty.

"It is accepted among experts that the dog is a 'natural' for sentry duty. Canines of various breeds have been used in protective duties for centuries. For example: When the King of Sparta found that he was making little progress in besieging the city of Mantineau because provisions were constantly being smuggled into the town through his own lines, the wise king ordered the city encircled with dogs. The enemy tried to slip past the animals by offering them bits of food but the dogs remained loyal.

"But the task of the modern four-legged sentinel is more complicated than that of his predecessors. He must do more than just watch. Today's dog has a better skilled, more deceptive enemy to combat, one who uses every shrewdness to perform a destructive act. The modern watchdog must be trained to meet the enemy on even terms.

" 'Dogs are like humans,' said Schoonover. 'They are individuals. General rules do not apply to training all dogs. Each one is different, but it's an ironclad rule that no one can train dogs who doesn't like dogs.'

"Bullmastiffs are ready for school at various ages, the average being eight months. At six months the young dogs are still in the puppy stage. But that is the time when a dog is taught to recognize its own name, the first step toward obedience. Later come the lessons in which the dog is taught to heel, lead attack, follow, stand, each lesson requiring from three to fifteen minutes. The primary training course takes from a month to six weeks.

"Upon completion of primary training the bullmastiffs enter the Ponca City kennels, where advanced training is completed and they are graduated to sentry duty. Here the dogs are trained to range in a zig-zag manner, to circle tanks and buildings to find the stealthy saboteur, to jump fences or gates in their search, to guard, to hold a prowler at bay until the master arrives, or to attack when necessary."

Lion to Lion and Bar Ton to Barton

How and why two blue ceramic lions of the Ming period of Chinese history came into the collection of Colonel T. H. Barton, president of Lion Oil Refining Company, are explained in the following from the "Naturaluber," house publication of the company:

"Once upon a time in the great land of China during the late Ming dynasty, there was a Chinese mandarin by the name of Lord Bar Ton. This honorable lord had become renowned about the empire because he collected oil from the earth which was much used medicinally. This oil was of considerable strength and Lord Bar Ton called it 'Lion.'

"So it came to pass that he was granted an imperial patent or grant which entitled him to the exclusive use of the name 'Lion' and the figure of a lion as a trademark for this oil which he extracted from the earth.

"Now it happens that Colonel T. H. Barton, president of Lion Oil Refining Company, is in full possession of the imperial patent and two handsome, blue ceramic lions of the Ming period which once belonged to the aforesaid Lord Bar Ton.

"These Chinese lions and accompanying patent, illustrated above, are gifts received by Colonel Barton from Colonel Frederick Pope, Director of Chemical Construction Corporation, traveler, voyageur and collector of curios from the far corners of the world, who found them in a shop in Shanghai some years ago. Colonel Pope explained in a letter to Colonel Barton: 'These things had been put away, but I ran across them the other day in looking through some things I had at the farm. The odd resemblance between the name of this Chinese mandarin, which of course was not "Barton" but "Bar Ton," struck me, and it seemed even more amusing that his oil should have been called "Lion Oil," and furthermore that it should have come from the earth.'

"The Ming dynasty, extending from 1368-1644 A. D., was an illustrious one and noted for its works of art. In view of the proof on hand . . . the original document and original trademark Lions . . . it seems that Lion Oil Refining Company can readily claim the oldest, most venerable name and trademark in the entire oil industry!"

Officials Elected by Arthur D. Little, Inc.

Roger B. Griffin, who was elected vice president of the chemical engineering organization of Arthur D. Little, Inc., Cambridge, Massachusetts, is a son of one of the founders of the firm. He had been treasurer, a position to which Henry G. Fowning was elected. Frank N. Houghton was elected secretary and Russell H. Stephens was chosen comptroller.

E. P. Stevenson was re-elected president. Vice presidents also re-elected are Raymond Stevens and Thorne L. Wheeler. The annual report of the president brought out that the organization now is engaged largely in activities related to the war. He is devoting most of his time to the work of the Office of Scientific Research and Development in charge of one of the branches of the National Defense Research Committee.

NO. 2 OF A SERIES

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No plant *ever* can afford a break-down or production slow-up, but in war-time it's a disaster! The best insurance in the world against trouble in piping systems is *welding* with *Tube-Turn fittings!*

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TUBE-TURN *Welding Fittings*

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FEWER SUPPORTS NEEDED: Since welded piping weighs less and stands vibration better than flanged systems, few hangers or supports are required.

The Liquefied Petroleum Gas Industry and Its Relation to the Aviation Gasoline and Synthetic-Rubber Programs*

PAUL M. RAIGORODSKY
Assistant Director, Natural Gas and Natural Gasoline Division,
Petroleum Administration for War

WAR has increased the tempo of rapidly changing technologic procedures. The normal technologic progress of yesterday is replaced with forced, fast-moving developments required in the production of essential war materials. Such operations dictate the use of raw materials and processes which will tend to hold critical material and time requirements to a minimum. Under these conditions, the use of liquefied petroleum gas in the synthetic-rubber and aviation programs is of genuine importance. In this paper, major attention will be focused on the effect the aviation fuel and synthetic-rubber programs will have on the liquefied-petroleum-gas industry.

The phenomenal growth of the liquefied-petroleum-gas industry during the past 20 years reflects the broadening scope of its applications. The introduction of liquefied petroleum gas in 1922 was accompanied by an annual market of 222,640 gallons. During the year 1941, the sale of liquefied petroleum gas reached the amazing figure of 462,582,000 gallons, and it is estimated that at present about 50,000 barrels per day is used for applications other than the quantities normally used in the manufacture of motor fuel. This astonishing growth is achieved in spite of the decrease of certain domestic markets due to wartime conditions, by the overall use of liquefied petroleum gas in the armed forces, defense housing, and war industries, together with a still greater use in the synthetic-rubber and aviation programs and the ever-expanding chemical industry. These increased demands upon the liquefied petroleum gas industry call for increased production, transportation, and storage in order that these valuable hydrocarbons may be available for fuel and as raw materials to contribute to the successful conduct of the war.

Production of Liquefied Petroleum Gas

Liquefied petroleum gases are produced at natural-gasoline plants, cycling plants, and oil refineries. These gases in general are composed of butanes and propane while fractions produced in refineries may contain appreciable amounts of butenes and propylene. Their removal is effected along with the heavier natural gasoline in field operations which may employ methods of high- and low-pressure oil-absorption, vapor rectification, refrigeration, compression and stage separation with or without extreme cooling. In the low-pressure oil-absorption process, refrigeration is required to effect efficient removal of liquefied petroleum gases. However, with modern high-pressure absorption processes this is not necessary, with the result that large amounts of liquefied petroleum gas are being extracted in high-pressure operations.

In natural gasoline operations, in addition to a select grade of natural gasoline, isopentane, butane, isobutane, and propane may be produced with dry gas as a by-product. The dry gas is available for pressure maintenance, fuel markets, or as a raw material of increasing importance in the chemical industry. The production of isopentane, isobutane, butane, and propane separately, or as a blend within themselves, or as a blend with heavier hydrocarbons is dependent upon market conditions. When liquefied petroleum gas, or more so, when isobutane and butane are required as a relatively pure product, from two to four fractionating towers are required for desirable separation and efficient recovery.

New critical equipment will be required to separate available, and to increase further, production of liquefied petroleum gas, but this requirement should be considered in the light of the value of these gases in the production of synthetic rubber, aviation fuel, and modern liquefied-petroleum operations, are utilized. New equipment will be required to stabilize and transport the desired additional amount of liquefied petroleum gas for war programs, but the increased production of liquefied petroleum gas necessary for war purposes will, in my opinion, be desirable and efficient and in no way penalize war-production work.

Concerning the quantity of liquefied petroleum gas available for all purposes, recent reliable estimates indicate that there are potentially available daily over 400,000 barrels of butanes at refineries and natural gasoline plants. With a modest expenditure of new critical material it may be safe to state that today a much greater amount of liquefied petroleum gas can be made available as a raw material for the liquefied-petroleum-gas industry, and the synthetic-rubber and aviation-fuel programs.

Utilization of Liquefied Petroleum Gas

In the use of liquefied petroleum gas are many advantages. It has been referred to as an ideal gaseous fuel. Its cleanliness, convenience, heat efficiency, ease of handling, and accuracy of control give it an assured place in domestic, commercial, and industrial markets. The use of liquefied petroleum gas in motor fuel is continuous and as a chemical raw material its future is assured.

Since the liquefied-petroleum-gas industry is no exception to other industries in time of war, its normal growth has been affected by restrictive orders. The War Production Board, in Limitation Order L-86, has allowed for new installations only for essential war work. Nevertheless, at present, some 2,000,000 domestic customers beyond gas mains enjoy the comforts of gas cooking, heating, and refrigeration.

The advantages of liquefied petroleum gas in industrial operations is well known. In addition to being an economic, perfect fuel, it may be used under conditions where gas supplies from pipe lines is not practical. Such cases would be seasonal loads with extremely poor load factor as in the manufacture of automobiles and isolated locations far from existing pipe lines. A normal future should see this fuel become of increasing importance; as an example, the development in the modern gas turbine, gas-operated radio and gas enrichment.

The use of liquefied petroleum gas for manufactured gas enrichment and as a standby for natural gas is an established fact. In addition, it may be distributed as a butane-air-gas mixture

*Before the annual meeting of the Compressed Gas Manufacturers Association, New York, January 26, 1943.

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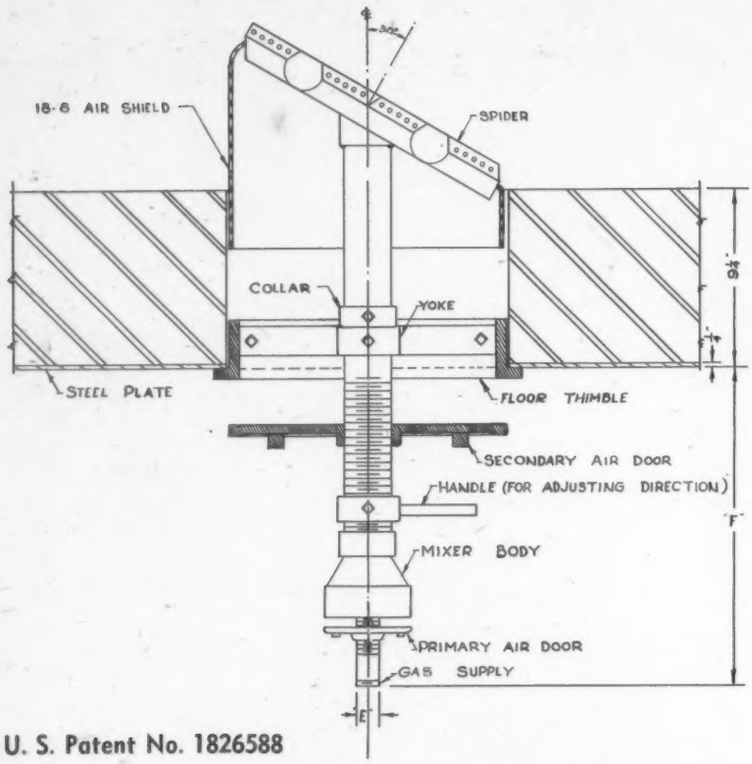

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in conventional gas distribution systems. This latter method is of increasing importance in supplying towns large enough for a distribution system but too far from existing supplies of manufactured or natural gas. The manufactured gas industry of today finds itself face to face with a grave condition because large cities are rapidly nearing the capacity of these distribution systems. Requirements of constant pressure conditions together with intricate design of these systems make increases in capacity practically impossible and only with great expense. One answer to this problem that has been adopted by some leading manufactured gas companies is the conversion to higher Btu gas. The manufacture of gas in excess of 550 Btu per cubic foot, in the absence of cold enrichment, is not economical in present day gas manufacturing sets. Higher Btu content of manufactured gas may be obtained economically and practically by the use of liquefied petroleum and natural gases. The use of liquefied petroleum gas in such operations and as a standby for natural gas will open new markets for this fuel when normal conditions return.

The use of liquefied petroleum gas as fuel for internal-combustion engines calls for special attention. Ethane, propane, and butane are the raw materials essential in the manufacture of modern aviation fuels. Ethane and propane may be cracked to ethylene, propylene, benzene, and toluene, and normal butane isomerized to isobutane. These raw materials may be processed by modern methods of dehydrogenation, polymerization, alkylation, and hydrogenation into the desired type of aviation fuel.

Normal butane is now being employed as a raw material to produce butadiene; ethane and propane to manufacture styrene (these materials yielding Buna S rubber). Isobutane on dehydrogenation yields isobutylene, the major constituent of butyl rubber. The liquefied petroleum gas is finding new uses every day, not only in the war industries, but in all phases of chemical operations.

Transportation and Storage of Liquefied Petroleum Gas

The physical properties of liquefied petroleum gas are of great interest and importance and to a great degree are responsible for the limitations which will be imposed on this industry during 1943. At average atmospheric pressure and temperature, they are gases and relatively close to their dew-point. This property allows for liquefaction at their source and with the use of pressure containers they may be transported and stored in this most convenient liquid form. In gas-consuming appliances, and generally when used as a chemical raw material, these gases must be returned

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Like so many others, you can get more productive minutes out of every man-hour by putting a Coppus "Blue Ribbon" Blower or Exhauster where it's needed.

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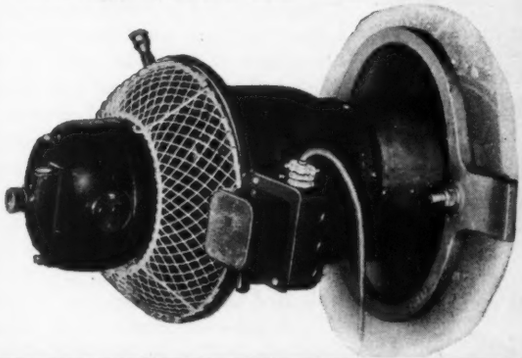


COPPUS

BLUE RIBBON BLOWERS

THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN-HOUR

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS ... DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON to Coppus Engineering Corp., 412 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in REFINERY CATALOG.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets, etc., after treated with coating material.

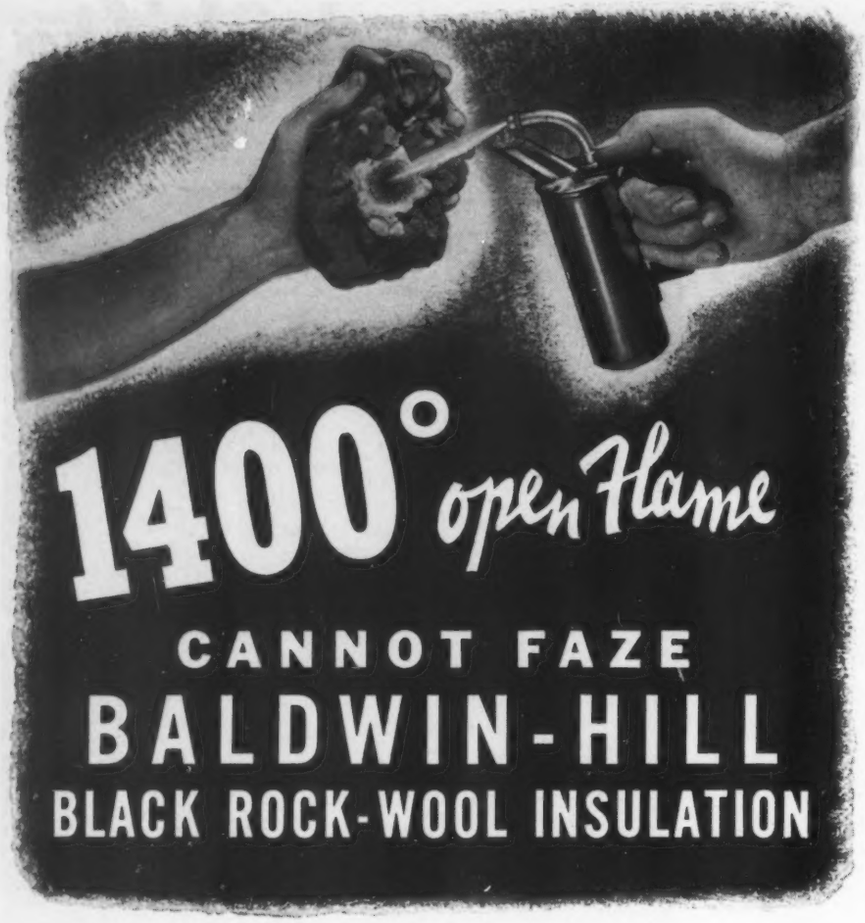
NAME .....

COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)



THE HIGH-IRON, low-alkaline nature of Baldwin-Hill rock wool is undisturbed by temperatures as high as 1400°. Exposures which completely remove the resiliency and strength from ordinary rock wool, flames which eat right through white wools, don't touch the strength or insulating power of Baldwin-Hill products. Add to that their stability in the presence of moisture, and you have two vital reasons for investigating Baldwin-Hill wools, felts, blocks, and cements—at once.

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FREE TO REFINERY MEN

A generous sample of Baldwin-Hill black rock-wool blanket, enough to let you test its heat-resistance, its firm, light texture, and its water-proof advantages. Note its expanded metal-lath surface which makes a cement finish so easy to apply. Simply write for your free sample on your business letterhead.

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to the gaseous phase. Knowledge of physical properties, together with rigorous research and development, has seen the liquefied-petroleum-gas industry develop and apply satisfactory storage, transportation, vaporization, and gas-pressure-control equipment to insure economy and safety in operation.

These unique physical properties dictate the use of containers which differ greatly from the conventional container now employed for liquids with low vapor pressure. The increased demand for liquefied petroleum gas has been accompanied by a demand for special containers for their transportation. This demand is amplified in that similar cars are required for the transportation of chemical raw materials such as isobutane, butadiene, and isobutylene. As previously stated, these products are gases at the normally prevailing temperature and at atmospheric pressure. If they are to be stored and transported at normal temperatures, they must, therefore, be stored in containers capable of withstanding considerable internal pressure. They may also be stored in insulated containers at low temperatures at little or no internal pressure.

In the shipment of liquefied petroleum gas, five types of transportation are available: bottle-gas cylinders, tank trucks, marine shipments, pipe lines, and tank cars.

Bottle gas cylinders are in general of limited capacity and are transported to customers for replacement of exhausted supplies. The empty cylinders are returned to plants, refilled, and the cycle completed. In addition to the plant customer route, these containers may be shipped on railroads and interstate truck carriers.

Tank trucks are available for local and long-distance hauling to insure the delivery of liquefied petroleum gas to individual domestic, commercial, and industrial consumers who maintain storage tanks on their own premises.

Recent developments have allowed for increase in size of containers employed in marine shipments. However, such shipments are still restricted to inland waterways and coastwise shipments with off-shore deliveries.

Pipe lines allow for the transportation of large quantities of liquefied petroleum gas in the liquid state, and these so-called "white" pipe lines will become of increasing importance in the future of this industry.

The shipment of liquefied petroleum gas by rail in special pressure tank cars, with capacities from 8,000 to 12,000 gallons, is now regular practice and governed by Interstate Commerce Commission regulations. It is this method of transportation which is of the greatest importance to the liquefied-petroleum industry and presents one of the out-

PETRO-CHEM ISO-FLOW* FURNACES

NOW SERVE

THE LEADERS OF THE OIL INDUSTRY...

More than 100 Petro-Chem Iso-Flow* Furnaces went into operation and under construction during 1942 for the manufacture of Styrene and Butadiene for Synthetic Rubber, Ethylene, Toluene, Aviation Gasoline, Lube Oils, etc.

Every hour Iso-Flow* Furnaces are proving their special adaptability for high temperature operations and special types of processing.

No new or established process or plant should neglect to take into consideration the many advantages of the ISO-FLOW* Furnace.

*Trade Mark. Patents issued and pending.

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Representatives: Bethlehem Supply Co., *Tulsa, Houston, Los Angeles* Faville-Levally Corp., *Chicago*

Amsco-Nagle Pumps *Welcome Abrasive and Corrosive Liquids*

Illustrated below is an installation of an Amsco-Nagle type "QW" vertical shaft wet pit sump pump with "V"-belt drive, handling welding rod coating, a thick abrasive slurry. The pump is down inside of the tube. A cutaway view of the Type "QW" Pump is also shown. Other recent applications include the pumping of phosphate slurry, water containing coke breeze, ashes, activated carbon, core sand, iron ore tailings, petroleum products, syrup and sewage.

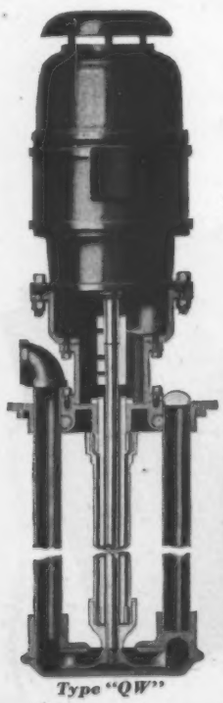
Amsco-Nagle pumps are correctly designed to handle abrasive and corrosive liquids for maximum service periods with minimum trouble. Not only are they preferred for the tough pumping jobs in the chemical and process industries, but, such is their reputation for long time operation with low maintenance, that they have been frequently chosen for handling clear, inactive liquids.

The reasons for the ever-growing use of Amsco-Nagle pumps are found in specialized design and in the materials of construction, which are varied according to the nature of the liquid or material to be handled. One type of impeller is applied for clear liquid; another type for light slurry or viscous liquids; and a third type for thick slurry or debris-laden liquid. Amsco Manganese Steel, stainless steel, white iron or corrosion-resistant Amsco Alloy are used for the water-ends of the pumps, depending on the materials to be pumped.

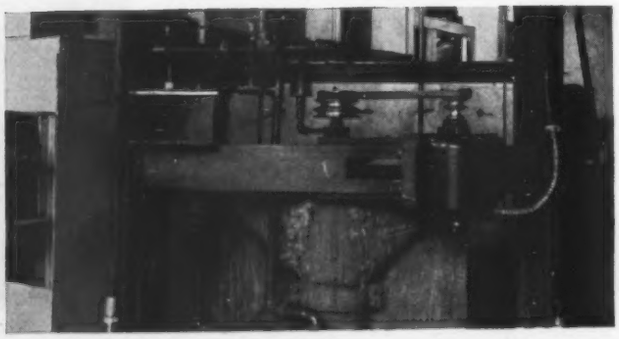
Every pump in this line is simply constructed with a minimum number of parts; impellers and bearings are readily accessible and easily replaced. To minimize recirculation or slippage, a close seal is maintained between the impeller and the side plates.

Amsco-Nagle Pumps are made in two horizontal and three vertical types; in sizes from 3/4 to 16 inch; with impellers as large as 38 inches in diameter; for capacities as great as 10,000 gallons per minute; and under some conditions for heads as high as 200 feet.

Bulletin 940 on Amsco-Nagle Pumps will be mailed on request.



Type "QW"



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Better steel requires more scrap!

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standing problems at the present time, in that it is of the greatest importance to the syntheic-rubber and aviation fuel programs.

The number of tank cars available for the transportation of liquefied petroleum gas, butadiene, and butylenes as of August 1, 1942, are as follows:

Liquefied Petroleum Cars (104A)	1,594
Cars Being Built (Rubber Reserve)	250
New Cars (Delivery starts 1-1-43)	100
Proposed Conversion from 104 to 104A	150
Total	2,094

Of the 250 cars being built for the Rubber Reserve, 120 have been delivered. As noted, the proposed conversion of natural-gasoline cars to 104A (pressure-type car) will make 150 additional cars available or a total of 2,094 to transport all types of liquefied petroleum gas.

In addition to the number of cars, the time required for a complete round trip is of the greatest importance. The problem of efficient tank-car usage is not one of static nature. The railroad systems of the United States are of intricate design and with source and points of consignment changing from day to day this problem becomes extremely complex. Therefore, a perfect pattern of tank-car movements today may be only 50 percent efficient tomorrow. Nevertheless, this most complex problem is now being satisfactorily and efficiently solved. The phenomenal result obtained today in the transportation of petroleum products is made possible by a continuous study and revision to give an overall high efficiency in turnaround time, cross-haul, and other movements to supply this most essential war material in the required amounts.

These conditions, as stated herein, will have profound effect upon the liquefied-petroleum-gas industry during 1943 and thereafter. In order that the liquefied-petroleum-gas industry may cooperate to insure complete accord in the war effort, certain facts of paramount importance must be observed and followed immediately by definite action. These facts, together with recommendations, are as follows:

Tank-Car Deliveries of Liquefied Petroleum Gas

The number of pressure tank cars available to the liquefied petroleum gas industry as such will decrease throughout 1943. This condition is brought about in that synthetic-rubber and aviation-gasoline plants are rapidly nearing completion and additional tank cars will be required to transport products such as butadiene, isobutane, butenes and other similar chemical raw materials needed in the war programs. These special type tank cars will be withdrawn

The Flag of Service

ABOVE are listed quality products manufactured by a modern plant manned by skilled workmen. Pressed Steel service is matched only by Pressed Steel quality . . . they are both tops.

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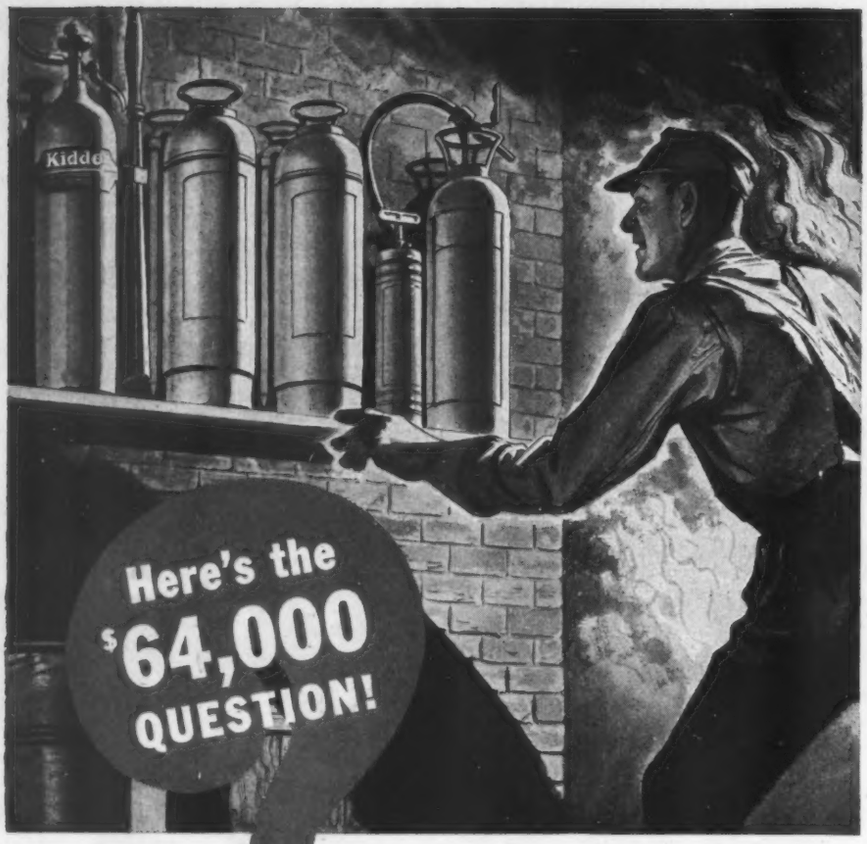
MANUFACTURERS OF: Carburizing and Annealing Boxes, Thermocouple Protection Tubes, Seamless Steel Cylinder Caps, Seamless Steel Neck Rings, Welded Alloy Tubing for High Temperature and Corrosive Application, Radient Tubes, Inner Covers and Base Sheaths for Steel Mills.



WHAT FIRE-KILLER WOULD YOU PICK FOR FIGHTING A BLAZE IN...

HOT OIL?
AN ELECTRIC MOTOR?
RUBBISH?
CARBON BISULPHIDE?
GASOLINE?

Get the wrong answer and it costs plenty! Fire can gain headway too fast, if you hit it with the wrong extinguisher.

All fires aren't alike. Neither are fire extinguishers. Special fire hazards call for special fire-fighting equipment. How are *you* fixed?

There's one easy way to tell. Look at the Underwriters' Laboratories' approval notice on your extinguishers. It will say something like "Classification A-2, B-2." The letters "A," "B" or "C" are what you are looking for. They tell if the extinguisher is OK for use on Class "A" fires (wood, rubbish, paper, etc.), Class "B" fires (flammable liquids) or Class "C" fires (electrical).

This simple check tells you if you have the right extinguishers standing guard beside your plant's varied fire hazards.

Kidde carbon dioxide extinguishers are for flammable liquid (Class "B") and for electrical (Class "C") fires. They snuff these blazes fast, smother them in a blasting cloud of snow-and-gas. Kidde carbon dioxide gas is one of the fastest known extinguishing agents.

Walter Kidde & Company, Inc., 217 West Street, Bloomfield, N. J.

Kidde
HIGH PRESSURE GASES • FIRE PROTECTION
PROTECTS LIVES

from normal operations during 1943 with but little notice. Therefore, steps must be taken at once to insure the satisfactory operation of this industry under these conditions. To offset the reduction in tank-car use, this industry must plan and perfect methods whereby tank cars may be emptied and made available for the return trip in a minimum of time. Transportation experts in the Office of Petroleum Administration for War have stated that liquefied-petroleum-gas deliveries may be increased 50 percent with 100-percent efficiency in turn-about time. Cooperation from the industry to this effect will allow for its normal operations when this decrease in the number of special tank cars is effected.

Expansion of the Liquefied Petroleum Gas Industry During 1943

The expansion of the liquefied-petroleum-gas industry along normal lines will be impossible during the present year and thereafter with the continuation of the war. New installations will be restricted to defense housing, war camps, war industries, hospitals, and other related prospects, but approval in the above will only be forthcoming when no other source of fuel is available.

Coordination of Operations

The liquefied-petroleum-gas industry must dovetail operations to insure the maximum use and effectiveness of all existing storage and transportation equipment. With changing conditions dictated by revised methods of tank-car use, the present storage and transportation equipment should be pooled and movements coordinated to allow for the handling of a maximum of liquefied petroleum gas with a minimum of time, labor, and critical material. The problems facing the liquefied-petroleum-gas industry during the coming year can only be solved by complete cooperation between all companies wherever possible.

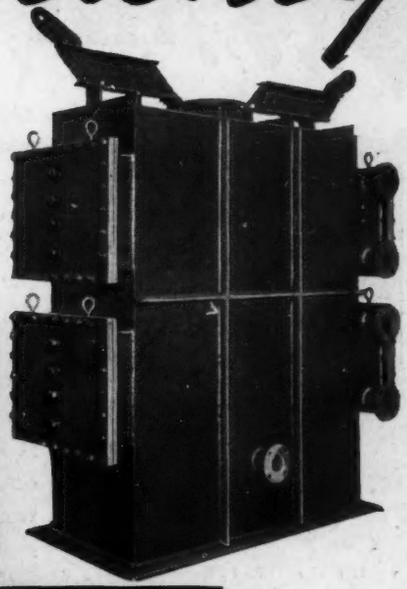
Storage of Liquefied Petroleum Gas

The storage facilities of liquefied petroleum gas must be expanded and so arranged that these products may be quickly and safely stored to eliminate any delay whatsoever in the return of the tank cars to active service. In the revision and construction of these facilities, of the greatest importance is the vapor pressure of the gas which is a direct function of the temperature of the liquid and also dependent upon the composition in terms of the hydrocarbons present. In these operations critical material will be required. With the present restrictions, this industry must endeavor to make use of second-hand and reclaimed equipment. Under these conditions, it is very important to ad-

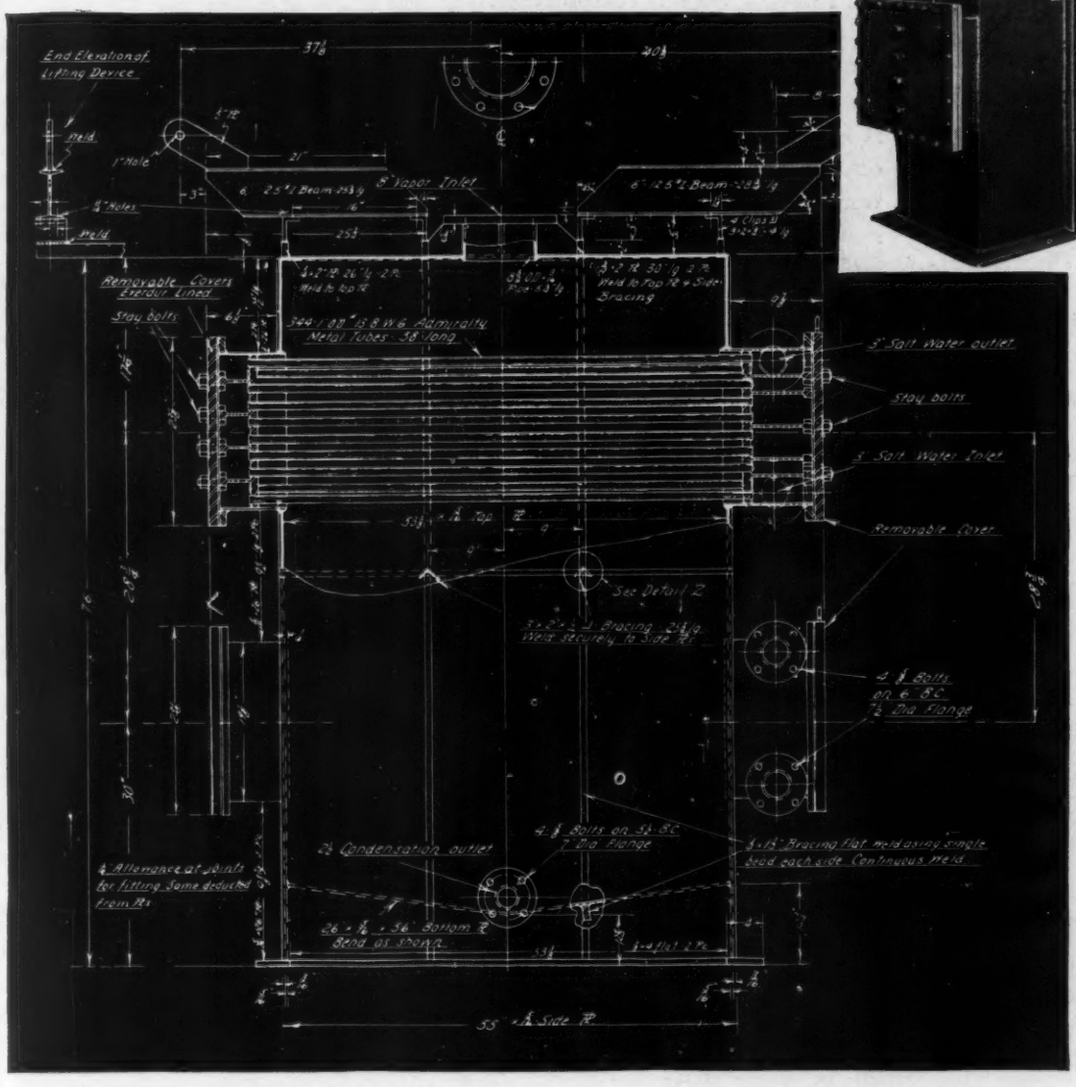
MULTIPLE CONDENSING UNIT RESULTS IN

Greater Efficiency

— WHERE SUB-COOLING LARGE VOLUMES OF OIL AND SOLVENT VAPORS IS REQUIRED



DRIP TYPE CONDENSER with multiple type condensing unit. Rectangular vapor chamber of reinforced steel plate, 75" high x 33½" wide x 55" long. Water channels, tube heads, coverplates and staybolts constructed of Everdur. Interior partitions of cast Everdur. Condensing surface of Admiralty metal.



SIDE ELEVATION OF CONDENSER—Where sub-cooling is required and there is a close approach between the temperature of the coolant and the final temperature of the condensate, this type of condenser is particularly efficient for handling large volumes of oil or solvent vapors. Materials or construction can be varied according to specific operating conditions.

PATTERSON-KELLEY *FOR DEPENDABLE, ECONOMICAL SERVICE*

EST. 1880

PATTERSON-KELLEY HEAT EXCHANGE ENGINEERS

THE *Patterson-Kelley* CO., INC.

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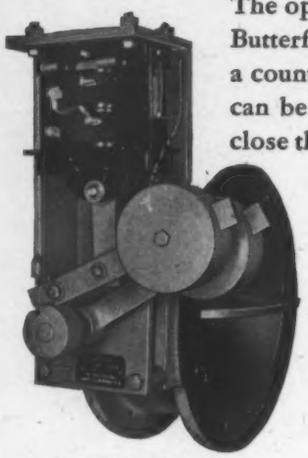
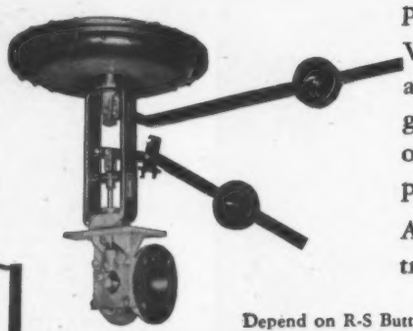
MANUFACTURERS FOR THE REFINING AND PROCESS INDUSTRIES

Emergency FIRE FIGHTERS



PATENT APPLIED FOR

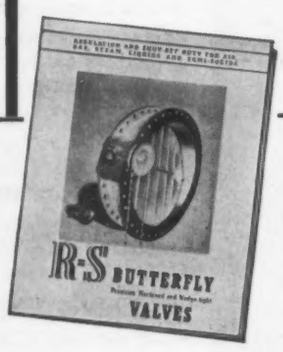
The operating solenoid in this assembly of an R-S Butterfly Valve connects to the valve vane through a counter-weighted lever and latch. The solenoid can be arranged with the mechanism to open or close the valve and hold it there in one position or the other. Failure in the current to the solenoid for any reason results in tripping the latch and permits the counter weight to close or open the valve by gravity. The assembly is suited for emergency use to shut-off flow wedge-tight or to open a vent. Used on sprinkler and foam systems, tank discharge, gas lines and for electrically driven blower protection.



Valve can be constructed of any alloy and in various sizes for air, gases, steam, oil, hydraulic and other services. Resetting is accomplished by hand.

A similar type trip valve can be controlled by pressure as illustrated.

Depend on R-S Butterfly Valves for low-cost, manual or automatic control and wedge-tight shut-off of volume and pressure. Sizes range from 2 to 84 inches.



15 to 900 P. S. I.

Wafer (narrow face to face) valves are suitable for pressures up to fifteen pounds. They are light in weight yet high in regulating efficiency.

Write for Catalog No. 10-B.

BUTTERFLY VALVE DIVISION

R-S PRODUCTS CORPORATION

120 Berkley Street • Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

here to all codes or standards as prescribed by regulatory and safety commissions to insure against accident.

The effects of the aviation-fuel and synthetic-rubber programs on the liquefied-petroleum-gas industry as stated herein are now becoming apparent. This condition will continue and grow with the duration of the war, therefore, the liquefied-petroleum-gas industry must acclimate itself at once to these changing conditions to insure normal operations and guard against breakdown.

Conclusion

The development and expansion of the liquefied-petroleum-gas industry was the result of a "big" idea which many people have tried to implement. The industry now is at about the same stage at which the natural gas industry was some 20 years ago. While it has a logical place in the national economy, up to date, in many instances, it has been operated in a more or less helter-skelter fashion. This is particularly true in the distribution end of the business where many operators have considered only the sale of equipment rather than the efficient utilization and distribution of the product itself.

Financing in many cases has been difficult because of the newness of the industry and because of the methods by which distributors approached saturation of the market.

During this wartime period when we are all straining to preserve the markets now being served and assist in the war effort, it strikes me as an excellent time for the industry to concern itself with studies designed to perfect the operations as well as the economics of the liquefied petroleum gas business. There is an interesting future ahead for the industry. There are ample markets to be served by it to give it a solid place in the national economy. Now appears to be the time to get this industry's house in order so that it may be ready, when this gigantic struggle is ended, to really take its place in the fuel picture of the nation. The future presents uncertainties to all industries, but it must be remembered that the disadvantages and reverses of today may be converted into the advantages of tomorrow. The history of this relatively new industry, to me, predicts that it will continue to serve satisfactorily its markets during tne war period and, with the alertness of those new engaged in the business, it should develop into a great industry with the return of peace.

Mac Short Elected President of SAE

Mac Short, vice president in charge of engineering of Vega Aircraft Corporation, Burbank, California, has been elected president of the Society of Automotive Engineers.

LICK
CORROSION PROBLEMS
with HOMESTEAD LEVER-SEALD PLUG VALVES

Hot caustic and frequent operation are tough service conditions; but the 2" and 3" Homestead Lever-Seald Valves used throughout this prominent plant lick them with long, low-cost, trouble-free service.

Valve troubles caused by corrosive or viscous fluids CAN be overcome . . . by using the RIGHT valves! Homestead LEVER-SEALD Plug Valves were designed to lick the problems of the refining and processing industries . . . corrosion, viscosity, temperature, pressure, operating frequency and similar trouble makers.

Built into each of these valves is a powerful leverage (lower lever on the valves shown), which relieves seating pressure between plug and body just enough to overcome friction and permit easy turning. Then a quarter turn of the upper lever fully opens or closes the valve; and full seating pressure is again applied to the lower lever to make a positive, leakless seal. Thus, right on each Homestead Lever-Seald Valve is the mechanism which makes possible unfailing "stick-proof" operation.

Additional invaluable features include seating surfaces protected in all positions; straight-through flow that minimizes pressure drop; positive sealing without contaminating lubrication; sealed bottom and deep stuffing box to prevent hazardous leakage. Available in sizes from 1½" to 10" for pressures from 150 to 1500 lb. and metals matched to service requirements. Write for Valve Reference Book No. 38.

MAKERS OF "PEAK PERFORMANCE" VALVES FOR 50 Years 1892 1942

HOMESTEAD VALVE MFG. CO.

P. O. BOX 16 • • • CORAOPOLIS • • • PENNSYLVANIA

Back on stream *20 hours sooner!*

What had been a 36-hour cleanout job using quite modern tools, became a 16-hour job when they put the 1100 series Elliott-Lagonda cleaner to work in a certain mid-western refinery.

The job was speeded by the ball-thrust bearings at each end of this cleaner motor. Practically *all* the power goes through to the cutters. The superior design of the Elliott-Lagonda cutter head and lasting quality of the cutters had a lot to do with it. And give some credit to Elliott-Lagonda cooperation by experts — who, with a veritable filing cabinet of experience, have produced the right answers to many tough problems.

But no matter what brought it about — a 20 hour saving on still down time is worthwhile in anybody's language. The Elliott man may be able to tell you how to get it. Or how to get even more. It happens quite frequently. Write.

ELLIOTT

LAGONDA TYPE

TUBE CLEANERS

SERIES 1100

are making astonishing new speed records!

Y-188

ELLIOTT COMPANY

Tube Cleaner Dept.

SPRINGFIELD, OHIO

DISTRICT OFFICES IN PRINCIPAL CITIES

Annual NGAA Meeting To Be Held April 14-16

The twenty-second annual meeting of the Natural Gasoline Association of America will be held in Dallas, April 14, 15 and 16. Sessions will be in the Baker hotel. The program, now being determined, will be confined to two days, leaving the opening day for committee sessions.

In announcing the meeting Ray E. Miller, Hanlon-Buchanan, Inc., association president, said directors had given serious consideration to governmental requests for trade groups to forego conventions.

"We appreciate the reasons which prompt this request," he explained, "but we believe the type of discussions planned for this convention are in national interest since they will aid the industry in correlating its efforts in the war program and thereby increase its effectiveness. The natural gasoline and distillate industries are large producers of the prime raw materials used in manufacturing high-octane-aviation fuels, rubber and chemicals, and a meeting of the executives and technical men of these industries to discuss the problems involved will have a definite stimulus to their production."

The program is being arranged by a committee, headed by James W. Vaiden, vice president of Skelly Oil Company, Tulsa. Others members are John B. Atkins, Parade Gasoline Company, Shreveport; Paul C. Coffin, Shamrock Oil & Gas Company, Amarillo; Howard Felt, Warren Petroleum Corporation, Tulsa; Dr. O. L. Roberts, The Atlantic Refining Company, Philadelphia; Harry Wheeldon, Lone Star Gasoline Company, Dallas; C. R. Williams, Chicago Corporation, Corpus Christi.

Appointments Made in Natural Gasoline

David G. Hawthorn has been appointed section chief of the production division of the natural-gas and natural-gasoline division of the Petroleum Administration for War. Another appointment is that of John H. Thacher, Jr., as technical consultant in the same division.

Hawthorn is chief of the newly formed section of materials and equipment, which will handle the equipment requirements and allocation for the production branch of the oil industry as affected by the controlled-materials plan. He is in Washington on leave from Amerada Petroleum Corporation, Tulsa.

Before joining PWA Thacher was in the executive office of the chairman of the War Production Board.

R. C. WHEELER

THE LOOK BOX

General Petroleum Announces Promotions

Election of Ray C. Wheeler as vice president and addition of G. F. Olsen, Sr., as a member of the board of directors, has been announced by General Petroleum Corporation. Wheeler was promoted to the management of all manufacturing activities of the company in December. These duties include supervision of refining, gas, laboratories, engineering and patent departments.

P. S. Magruder has been promoted to manager of the gas department, an advancement from the assistant managership. In this department W. M. Kibre has been promoted from engineer to superintendent.

Wheeler has been with General Petroleum Corporation since the end of the first world war. He came to California as a research chemist and worked as a consultant for the Army Ordnance Department in connection with the making of toluol from petroleum. Previously he had been with United Gas Improvement Company, Philadelphia.

His first duties with General Petroleum Corporation placed him in charge of the experimental laboratory. Since then he served as general superintendent of the gas department and then as manager of the natural-gasoline and natural-gas operations. He was president of the California Natural Gasoline Association in 1932 and has served as a vice president of the Natural Gasoline Association of America.

Olsen has been with General Petroleum Corporation since 1925 when he became a consultant in the manufacture of lubricating oils. In 1932 he became manager of laboratories. He is a graduate of Purdue University and was connected with both Indian Refining Company as manager of refining and Union Oil Company as superintendent of refining previous to his connection with General Petroleum Corporation.

First Butadiene Unit Goes Into Production

First of four butadiene new units of Standard Oil Company of Louisiana, Baton Rouge, went on stream January 29. It has daily capacity of 6600 to 9000 tons, the yield depending on the material used as charge stock. It is the largest plant to be put in operation for making synthetic-rubber raw materials.

The plant was planned and privately financed by Standard Oil Company of Louisiana, which intended to use the output for its own production of special types of synthetic rubber then in commercial demand. It was scheduled for completion in October, 1942, but delay resulted from shortages of critical construction materials. Before Pearl Harbor, Rubber Reserve Company contracted with the company for the entire output of this plant in order to speed up the synthetic-rubber program.

A smaller unit of similar design has been in operation for a year. Three additional butadiene units at Baton Rouge, which are wholly or partly financed by the government are well along toward completion and will be coming into production successively during the next three months.

Shell Wood River Plant Gets Army-Navy Award

An award for excellence from the Army and Navy went up at the Wood River refining plant of Shell Oil Company January 15, while pins were given to workers in the plant. Ceremonies at the plant brought representatives of the armed forces, civic officials, company officials and workmen into a joint program of acceptance of both the pennant and the pins.

The program was significant in that it brought a message from General James H. Doolittle in North Africa, while his wife was one of the speakers. Doolittle was with the Shell organization until three years ago. His message thus described the award, "it is the Distinguished Service Cross of the production soldier."

Thomas N. Dysart, president of the

G. F. OLSEN, SR.

Shell Wood River Employes Accept "E" Award

St. Louis Chamber of Commerce, was master of ceremonies. The Army was represented by Colonel Merle H. Davis, who presented the pennant. Robert C. Roberts, manager of the refinery, accepted for the workers.

Commander W. F. Veatch represented the Navy and presented the pin which will go to each worker. Raymond H. Sanders, president of the Metal Trades Committee, accepted for the plant personnel.

The fact that awarding of the pennant came in the twenty-fifth year of the history of the Wood River plant was singled out by Alexander Fraser, president of the company, who added, "having started operations in the first world war, Wood River has achieved the signal honor of being the first refinery in the second world war to receive the Army-Navy production award —a unique distinction for any company at any time in any industry.

"This award is a tribute to the important role which you men and women have played in the war effort as well as to the technical research behind you, which has made possible the production of vast quantities of vital war materials. It is this persistent, ceaseless search for new production from petroleum, as well as the constant improvement in the quality of existing production, which has contributed so much to the progress of our industry in recent years. And it would be remiss of me not to call attention to the fact that technical research and the benefits which flow from it constitute our best guarantee of continued employment after the war."

Workers in the plant were represented on the platform by the Operating Engineers and the Metal Trades, the former by A. H. Magill, member of the executive committee; Percy Lauck, secretary, and Ira Killan; the latter by Raymond H. Sanders, president; R. L. Turner, secretary; A. J. Gurley, M. A. Payne and Archie Preston.

Officials of the company from New York, in addition to President Fraser, included: F. A. Guepin, vice president; J. W. Watson, treasurer; J. F. M. Taylor, vice president in charge of manufacturing; N. J. McGaw; C. F. Davis, manager of the manufacturing department; P. H. Swinchatt, vice president of Shell Pipe Line Corporation; B. H. Wymon. manager of lubricating sales; G. G. Biggar, manager of public relations; H. F. Brown, sales promotion and advertising representative; Jack Ebel, editor of Shell News.

Other officials present were R. B. Roark, vice president, Tulsa; E. G. Robinson, manager of Eastern production, Centralia; L. A. Lohman, industrial relations department; R. B. High, manager of the Washington office; H. Swanson. division manager at Chicago; J. G. Sinclair, division manager at Indianapolis.

National Registry Seeks Location of Rare Chemicals

The National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Federal and Dearborn Streets, Chicago, has received urgent requests for the chemicals listed below. If any one has one or more, even if only in one-gram quantities, please inform the registry.

1. 3-Pyridine Acetic Acid.
2. 2,4,6,2',4',6' Hexachloradiazoamino -benzene.
3. 2,3,5-triiodophenoxy acetic acid.
4. 2,3,5-trichlorophenoxy acetic acid.
5. Dimethyl Acetylene.
6. Methyl Carbimide.
7. di-n-hexyl amine.
8. di-n-heptyl amine.
9. di-n-nonyl amine.
10. Any tetrahydro phenanthrene acid.
11. Dibromoiodomethane.
12. Margaric acid (Hepta-decanoic acid).
13. Normal octanol.
14. Normal decanol.
15. Methyl-octanyl-amine.

Enemy Oil Patents To Be License Free

More than 400 patents and 26 applications for patents dealing with mineral oils have been taken over by the Alien Property Custodian and are being made available to American industry without payment of royalties. Licenses already have been issued for the production of sulphur from "sour, gas, rust and corrosion inhibitors and other products.

These patents were among the more than 50,000 standing in the name of nationals of enemy and enemy-occupied countries when we entered the war, seized under the Trading with the Enemy Act.

Where exclusive licenses are not already outstanding to American industry, APC will issue non-exclusive and non-assignable royalty-free licenses for the life of any enemy-owned patent to any reputable firm or individual, for a fee of $50 for each single patent, plus $5 for each additional related patent to be covered in the same license.

Licenses will be granted on the same terms for patents owned by nationals of enemy-occupied countries, but the royalty-free provision will apply only for the duration of the war and six months thereafter, at the end of which, royalties which are reasonable on the basis of prevailing commercial practice will be charged.

Exclusive licenses held by American industry under patents which have been taken over will be examined but will be allowed to stand if they do not contain restrictive provisions illegally curbing production or use or detrimental to the war effort. Holders of such licenses, however, may relinquish them and accept a non-exclusive royalty-free license. Where the original licenses are retained, the royalties are to be collected by APC.

Rubber Program Extended Rather Than Curtailed

Extension rather than curtailment of the synthetic rubber program was the explanation given by Donald M. Nelson, chairman of War Production Board, in early February as a clarification of the bickering and controversy between heads of other agencies of government.

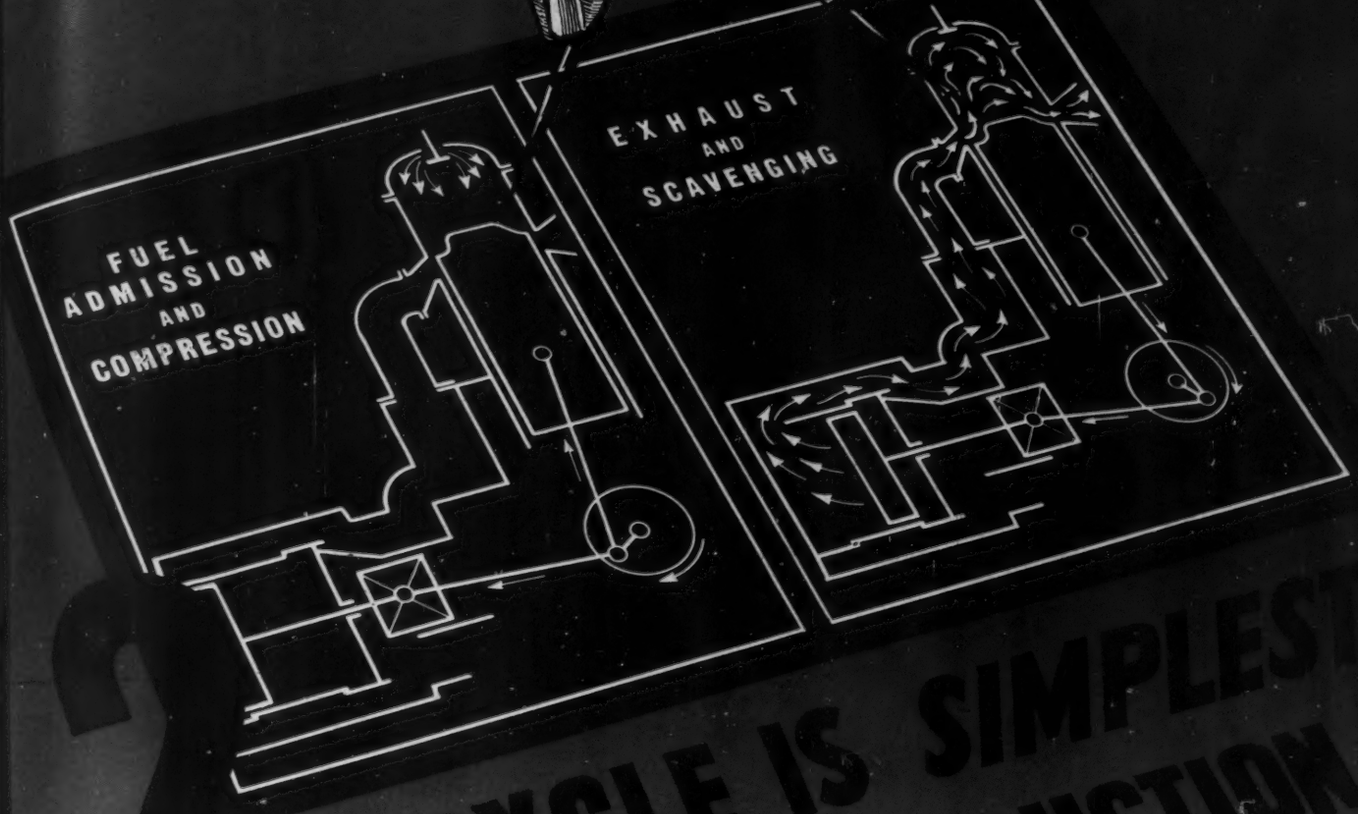
He said that immediate completion of plants to make 55 percent of the anticipated Buna S rubber simply meant that this part had precedence and that the remainder would follow in its proper relationship to the full war program.

By July he said plants capable of making synthetic rubber at the rate of 435,000 tons per year would be in operation. On this point he laid stress on the proposition that this does not mean the whole rubber program has been reduced to 55 percent of its former total.

"It simply means," he explained, "That 55 percent of the plant capacity will be assured to completion and operation in the next several months. Now that this part of our capacity is provided with certainty and remainder of the synthetic-rubber program will go forward in proper balance with the other acute needs."

Synthetic-rubber ingredients and 100-octane aviation gasoline are two of what the WPB chairman styled "must programs."

"We can not permit," he explained, "any of these programs to lag behind



2-CYCLE IS SIMPLEST ENGINE CONSTRUCTION

NO VALVES TO GRIND

Simplicity of design — few moving parts — are tremendous advantages in mechanical equipment. The 2-cycle engine possesses these great advantages over the 4-cycle. It has an uninvolved fuel injection system — no exhaust valves: it represents the extreme of simplicity in operating principle.

Note the simplicity of CLARK Super-2-Cycle operation, diagramed above. Every up-stroke compresses a fuel mixture. Every down-stroke is a power stroke. There is no "waste stroke", to cut power in half and double wear and tear. Scavenging with 26% excess air is instant and thorough.

Other basic advantages in the CLARK 2-Cycle are: 1. Greater Fuel Economy; 2. Less Wear; 3. Smoother Operation; 4. Fewer Man Hours; 5. Lower Oil Consumption; 6. Lower Installation Cost.

Investigate these claims. Our engineers are at your call.

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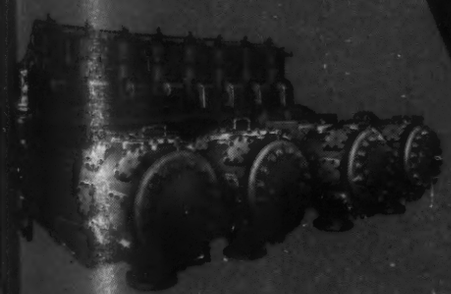
Export Office: 30 Rockefeller Plaza, New York. Domestic Sales Offices and Warehouses: Tulsa, Okla.; Houston, Tex.; Chicago, Ill. (122 S. Michigan Ave.); Boston, Mass. (131 Clarendon St.); Huntington Park, Calif. (5715 Bicket St.) Foreign Offices: 72 Turnmill St., E.C. 1., London; Avda Roque Saenz Pena 832, Buenos Aires.

AFFILIATED COMPANIES: Dresser Mfg. Co., Bradford, Pa.; Pacific Pump Works, Huntington Park, Calif.; Bryant Heater Company, Cleveland, Ohio.

CLARK
Super-2-Cycle

CLARK 3-Cyl., 300 H. P.
"Super-2-Cycle"
Angle Compressor



CLARK 8-Cyl., 800 H. P.
"Super-2-Cycle"
Angle Compressor

essential requirements and we are not permitting that to happen.

"The big production programs compete with one another for alloy steel, copper, aluminum, and for such finished equipment as valves, heat exchangers, and blowers. If we allow too much of any material to go, let us say, to the cargo-ship program, warship production may suffer; or if we concentrate too much on a certain type of equipment needed for rubber production, production of high-octane gasoline for our air force may bog down.

"Obviously that cannot be allowed to happen. The problem has been to strike a balance between the conflicting problems so as to arrive at a balanced overall production schedule. The aim of such a schedule is not to show spectacular figures in any one field of production but to achieve a maximum benefit for the war effort as a whole."

"What we have done with respect to rubber and the other major programs represents this board's considered judgment as to the means by which the needs of this nation's war effort can be best served, not any one economic section of the nation, but the nation as a whole.

"At the same time our policy is necessarily flexible. Production schedules may need to be changed at any time, to reflect changes in the availability of materials and equipment and the requirements of the various theaters of war."

This summary of a settlement came after two weeks of controversy between William M. Jeffers, the Army, the Navy, the Maritime Commission and a few pleas by Petroleum Administrator Harold L. Ickes, whose 100-octane aviation gasoline program had treatment similar to that for butadiene units. The five "must" programs evidently are ammunition, cargo vessels and escort ships in addition to the two petroleum products.

Curtailment of the programs came after the issues had been taken to the White House, where Stabilization Director Byrnes made the decision. Ickes made it plain that he was not satisfied with the decision although he admitted that had he been in Byrnes' position he could have reached no fairer conclusion, and said he would continue to fight for the full program which he had outlined, details of which, of course, could not be revealed because of their military importance.

Aviation gasoline, he said, should be one "of our primary objectives," but is not being produced in the quantities desired. While all military demands have been met, he disclosed that this was possible because the Army and Navy knew the situation and adjusted their requirements accordingly.

Whether the readjustments necessary to meet proposed new Army specifications raising the quality of gasoline above 100-octane would be justified in the light of existing conditions remains to be determined, he said. Inability to build plants on schedule, Ickes said, has been due to delays in getting priorities. "If we had been allowed the priorities which we were allowed, at the time they were specified, the program would be in much better shape than it is today," he explained.

The clash between governmental agencies came to public notice in late January when Rubber Director Jeffers, speaking before the conference of state officials at Baltimore, pointed to "military experts" in manufacturing plants as a source of delay in making equipment. Both the Army and Navy were criticised for having inspectors and expediters in plants, who were classed by Jeffers as being responsible for delays.

Congressional committees then took up the charge and before the House Naval and Military Affairs Subcommittee, he explained his previous charge and told the committee that not a single pound of synthetic rubber had been made in a government-owned plant, "due to Army and Navy interference and bickering over priorities.

"It seems to me the job of the Army and Navy is to fight and not attempt to run business.

"The whole controversy has been in getting priorities from the War Production Board. The worst difficulty is to get decisions as to what is first and what is second. There are too many people still experting on the rubber program."

Jeffers complained that while there have been a lot of conferences on priorities for rubber plants, no decisions have been made that "seem to stick."

Discussing military interference, the rubber director said he had been told the Navy had from 10,000 to 15,000 "expediters" in defense production plants and is seeking more.

"Filling up these plants with so-called expediters who tell the superintendent how to run his own shop are among those things that are delaying production," he commented.

In support of his views, he read from a letter written by a defense worker whose name was retained in confidence. The writer declared that many inspec-

A reproduction from an actual unretouched color photograph which illustrates the appearance of the gauge glass from directly in front.

"Our gauge glasses are perfectly illuminated"

"This is a modern power plant," explained the Chief, "carefully planned to the last detail. There's a light over every gauge glass, so they're very easy to read. A red lined glass would undoubtedly help in some plants, but it's unnecessary here."

The fact is, however, that PYREX Broad Red Line Gauge Glasses are easier to read *anywhere*, in a well-lighted or a poorly lighted situation. Hang a small calendar and a big one on the wall. The big one is easier to read from across the room, *in any kind of light.* So is a PYREX Broad Red Line Gauge Glass—incomparably easier to read from a distance. That's a safety feature, as you well know. And it's a feature that saves steps and saves time.

They also last longer, and that's your first demand. They're made of PYREX brand borosilicate glass—the same type of glass in which your wife likes to bake, and store things in the refrigerator—the same type of glass the chemical industry uses for piping because of its extraordinary resistance to corrosive action.

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Pyrex Gauge Glasses

BOUND VOLUMES

Bound volumes of *Petroleum Refiner* from No. 9, 1930, through No. 20, 1941, are available from subscriber, whose activity has changed and it is no longer advisable for him to maintain his petroleum library.

Inquiries directed to the publication, P. O. Box 2608, will be forwarded to the owner so the transaction can be carried on through correspondence.

tors "certainly impede production. They seem to think we are building ornaments, instead of armaments."

Jeffers testified that, because of "confusion, clashes of personalities, too much experting and too little two-fisted direction," little progress was made on the rubber program between the spring of 1942 and the submission of the Baruch report.

However, he admitted, little has developed since he made his first progress report in November, except a series of "resistent discussions" over priorities, and the delay has become so serious that it has not only endangered the entire rubber program but has delayed other related war programs.

He explained that there is little difficulty in procuring materials for the construction of plants, but the productive machinery to go into them has been lacking because the Army and Navy claimed they needed the equipment.

In response to a request for his views as to the most important things in the war program, Jeffers said:

"The armed forces come first as to rubber.

"One-hundred-octane gasoline is important.

"Aid to our allies comes next.

"Essential driving and farm production next.

"What is left we, the people, get."

Dedication Party for Third Catalytic Unit

When Standard Oil Company (New Jersey) completed the first unit of new fluid catalytic units in one of its own plants, the occasion was marked by ceremonies at Bayway, New Jersey. The event January 18 brought several scores of newspaper men inside the refinery yard, for a tour of the works and an opportunity to ask questions ahead of the ceremonies inside the boiler shop.

The dedication was the first public appearance of R. W. Gallagher since his election as president of the company.

The unit now operating at Bayway is the third to go on stream. One in Louisiana and one in Texas have been on stream for several weeks. These, however, are being operated by subsidiary companies, while the Bayway unit gives the patent holder its first finished products from a method wherein the catalyst moves with the vapor charge, hence the designation of "fluid catalyst."

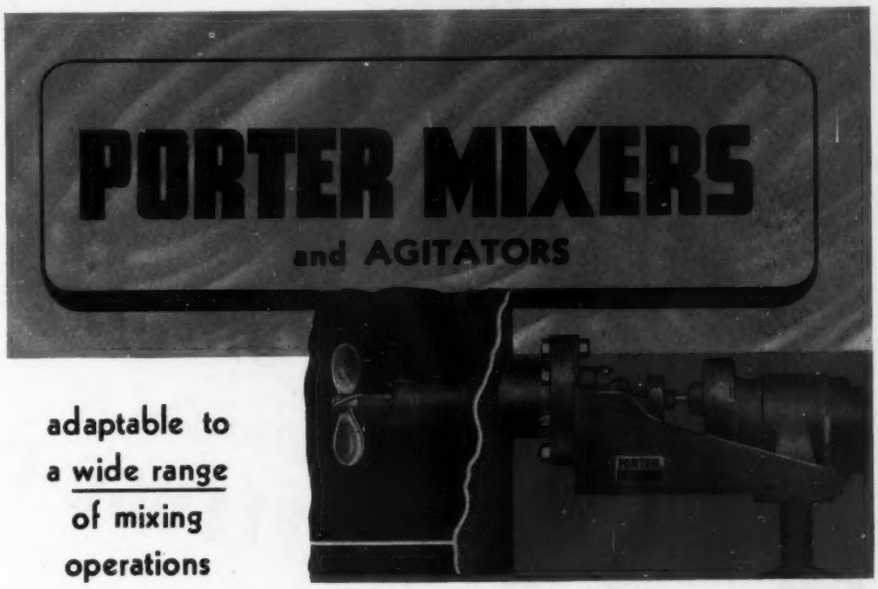
Among other things Gallagher let it be known that 30 additional units are under construction. Few of these will be operated by either Standard Oil Company (New Jersey) or its subsidiaries. This process is being licensed to others, with the result that it will be the source of the greater part of the 100-octane-aviation gasoline and of charge stock for butadiene manufacture. He gave this brief description of the process:

"Once the oil and catalyst meet, cracking takes place in a matter of seconds. It is a continuous process, which has eliminated many steps in refining. Previously, aviation base stock gasoline could be made only from limited supplies of selected crudes. The base stock in fluid-catalytic cracking is of higher octane number than can be produced from any selected crude and requires practically no further processing to meet the stringent stability requirements for use in present day aviation fuels."

Diakel Corporation To Build Plant

A contract has been signed by Diakel Corporation, Cincinnati, Ohio, and Defense Plant Corporation to provide plant facilities adjacent to the present plant of Diamond Alkali Company, Standard Silicate Division. The estimated cost of the plant is in excess of $2,000,000. Diakel Corporation will operate the plant, although title will remain in Defense Plant Corporation.

Diakel Corporation was incorporated recently in Ohio, and is owned jointly by Diamond Alkali Company, Pittsburgh, and M. W. Kellogg Company, New York. The latter company is designing and building the plant.



With the production of synthetic rubber and high-octane gasoline bringing radical changes in refinery operations, *adaptability of equipment* to the new processes becomes vitally important.

Porter Mixers take such changes in their stride. Because of their advanced design, extra sturdy construction and flexibility of operation, Porter Mixers are easily adapted to a wide range of blending or mixing operations.

Illustrated above is the new, improved Porter Side-Entering Mixer—an ideal installation for many of the new processes. Like the Porter "Whirlpool" Flange-Mounted Mixer for vertical mounting, and the Porter "Whirlpool" Portable Mixer, the Side-Entering Mixer is designed to give long service with a minimum of maintenance attention. Write for complete details and literature.

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H. K. PORTER COMPANY, INC.

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THE M. W. KELLOGG COMPANY
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Houdry Announces Catalytic Process

Houdry Process Corporation in January made public another development in catalytic cracking, its adiabatic process, which had its start in catalytic dehydrogenation in butadiene production. The further development in relation to motor fuel is being credited with providing a means of increasing the output of aviation gasoline base stock with heavy naphthas as the charge.

Because of military secrecy requirements no details of operation can be made public on the new process. That part of the official announcement dealing with this phase of the process follows:

"The Houdry adiabatic process was developed early last year in the search for an economical, certain method for making butadiene, main ingredient of Buna S synthetic rubber. The principle was thoroughly tested in a semi-commercial butadiene plant built several months ago by Sun Oil Company. This was the first plant to be completed demonstrating beyond all doubt the feasibility of producing butadiene by a catalytic process on a reasonably large scale, with perfect control and without operating difficulties.

"Houdry scientists thereupon termed their attention to adapting this adiabatic principle to the production of aviation fuel by catalytic cracking. They completely developed the process on a pilot-plant scale with startling results. Engineering and construction of commercial units now are under way.

"Technical details of both the new aviation fuel and butadiene process must be kept secret for military reasons. However, this much can be said:

"The enemy of all catalytic processes for cracking oils and gases is carbon, which impairs catalytic activity. Houdry scientists alone in the catalytic field developed the technique for turning this troublesome factor into an advantage. This method converts the carbon deposit on the catalyst into heat necessary to rearrange the hydrocarbon molecules into the desired product—in this instance, super aviation fuels—without the use of materials for equipment to handle extraneous heat exchange."

NGAA Offers Tentative Measurement Standard

Largely from the material presented at its 1942 annual program by Dr. D. L. Katz, University of Michigan, the Natural Gasoline Association of America has published the "N. G. A. A. Tentative Standard Method for Calculation of High-Pressure-Gas Measurement." It is the first publication of its High-Pressure Division.

The foreword of the publication gives an explanation of its nature and objectives:

"The metering of natural gases through orifices under high pressure creates problems of two types. First, the calculation of the quantity of gas flowing through the meter requires the density of the gas. This usually involves a choice of the correct compressibility factor to account for its deviation from ideal gas laws. Second, the reduction in pressure accompanying flow of a natural gas at high pressure may cause liquid to be present from retrograde condensation. This liquid may interfere with uniform meter operation and must be included in the density of the gas flowing.

"Because of the very nature of the subject covered in this publication, the material is not presented in the formalized style common to most technical standards. Instead, it appears as an informal discussion of procedure, together with its supporting data and reference bibliography.

"Part I presents a tentative standard for obtaining orifice correction factors to account for the deviation of gases from ideal gas laws at high pressure. This factor has been combined with the gravity and temperature factors to simplify the calculation of the meter quantity since both the gravity and temperature are required to determine the compressibility factor.

"Part II presents the details of an investigation of the reliability of the compressibility factor method for gas density calculations and compares the experimental and calculated compressibility factors on a number of natural gases."

Copies of the publication are available through the association, 922 Kennedy Building, Tulsa, single copies are 50 cents each; 10 to 24 copies, 45 cents each; 25 or more copies, 40 cents each.

Industry Assigned Steel, Copper, Aluminum Quota

The amounts of soft steel, copper and aluminum to be used by the oil industry during the second quarter of 1943 have been fixed under allocations of those materials by the War Production Board among the 14 claimant agencies, which includes PAW and Office of Rubber Director.

Full provision has been made in the allotments for the "must" programs on synthetic rubber, and high-octane gasoline, but the less essential programs have been cut to the bone, officials said.

Divided among the 14 agencies were some 17,000,000 tons of steel, 15,000,000 tons of which was carbon steel and 2,000,000 tons alloy steel; 600,000 tons of copper and about 600,000,000 pounds of aluminum. Details of the allocations were kept secret for military security.

Holsten President of Gulf Coast Refiners

Frank E. Holsten, executive vice president of Chalmette Refining Company, New Orleans, has been elected president of Gulf Coast Refiners Association, which maintains headquarters in Houston. Holsten will represent the association as a member of the Petroleum Industry War Council in Washington.

His election followed the retirement of D. W. Hovey, formerly vice president of Republic Oil Refining Company, Houston.

C. W. Eckman Joins Northwestern Refining

C. W. Eckman, who has been with H. K. Stahl Company, St. Paul, for the past 14 years, has been appointed assistant general manager of Northwestern Refining Company, also of St. Paul.

The company operates a 3500-barrel refining plant and barge terminal. Arthur T. Erickson is president and Elmer R. Erickson is treasurer and general manager.

Relations of WPB And PAW Clarified

The War Production Board has released the substance of a letter outlining the division of responsibility between WPB and PAW in connection with actions affecting the oil industry.

Designed to clarify the situation arising out of the issuance of the President's executive order creating PAW, the letter, embodying the "mutual understanding" of Nelson and Ickes regarding the division of authority, provided for the following relationship:

"1. Under Executive Order 9276, the administrator will issue directives and orders to the petroleum industry relating to the production, refining, treatment, storage, shipment, receipt and distribution within the industry of petroleum products or associated hydrocarbons as defined in the order. To avoid confusion with WPB actions, the administrator's actions will be designated 'petroleum directives' or 'petroleum administrative orders.'

"2. The administrator also may take action, to the extent specified in the order, concerning the distribution within the industry of other products or material, including the granting or denial of priority, allocation or preference-rating assistance to the industry. Such actions will be subject to program determinations and other directions of the WPB chairman and will be issued in the name of WPB's Director General for Operations. The administrator's signature will appear on such documents so that the industry will be able to distinguish between actions originating in WPB and those originating with PAW.

"3. The administrator will give WPB reasonable advance notice and opportunity for consultation before taking any of the actions outlined above, excepting in case of an emergency, by mutual agreement with certain WPB officers, or in cases where the proposed action will not affect more than two members of the industry, provided the members do not represent the majority of the particular branch of the industry affected.

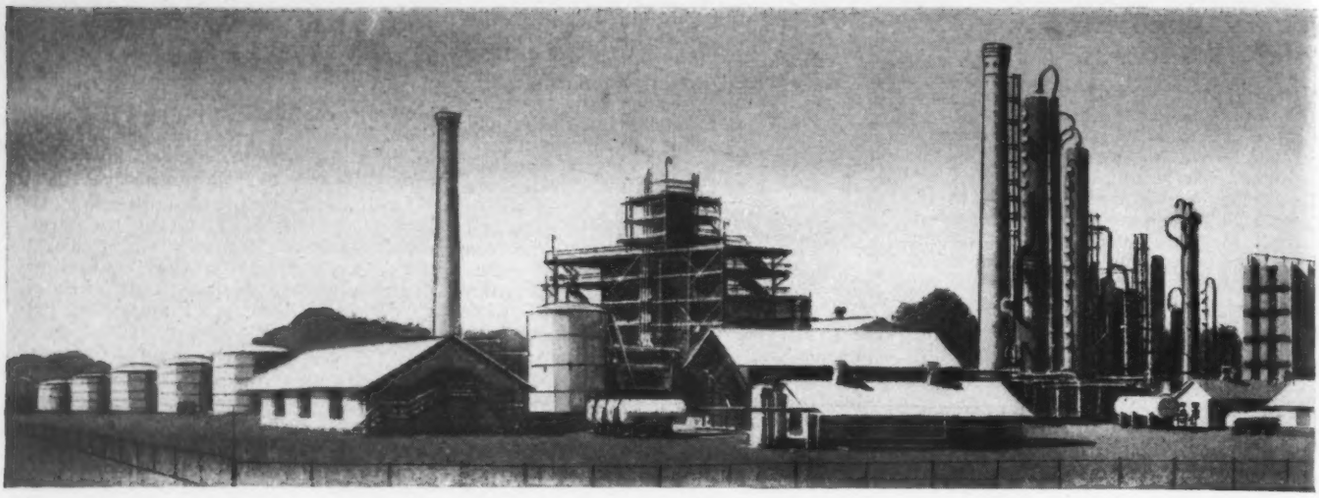
"4. WPB will continue to give the Office of Petroleum Coordinator for War reasonable notice and opportunity to be heard concerning all actions which might affect the petroleum industry, subject to the same exceptions as those set forth above.

"5. The administrator will give WPB five days' notice before taking action affecting products or hydrocarbons not deemed to come within the definition of petroleum products and associated hydrocarbons contained in the Executive Order.

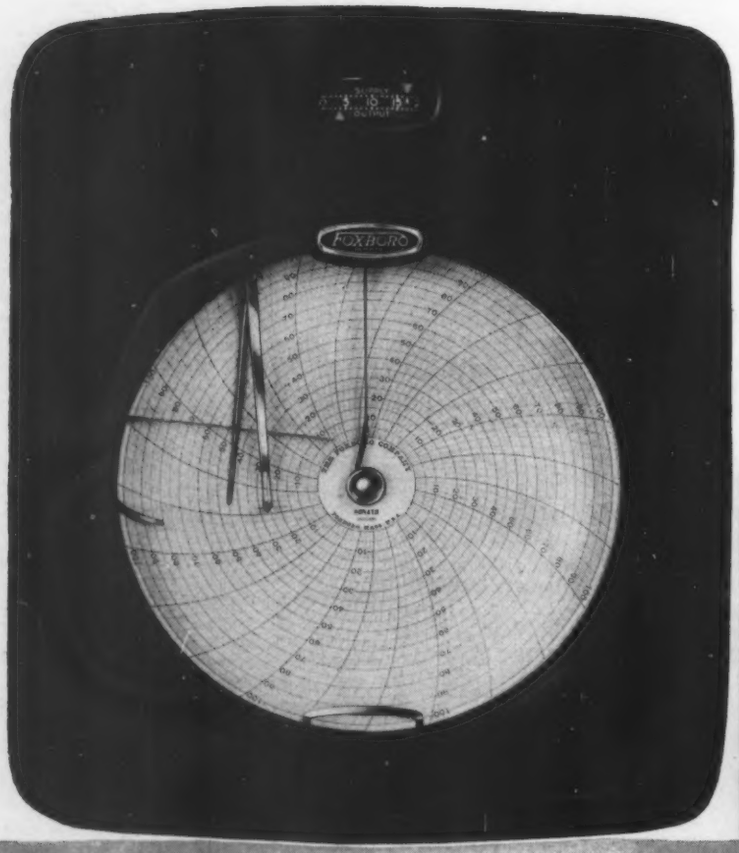
"6. The administrator will provide the means for enforcing all 'petroleum directives' or 'petroleum administrative orders.'

"7. As soon as possible, WPB orders which come within the provisions of paragraph 1 above will be reissued by the administrator, and the WPB orders will be revoked. This includes L-70, regulating shipments of motor fuel, and all orders in the M-68 series, which deal with petroleum production and marketing material and conservation of petroleum material.

"Procedures for giving the notices referred to in paragraphs 3, 4 and 5 above will be worked out between PAW and the Deputy Director General for



Picture of a 1943-Model



HYPER-RESET in the Stabilog Controller sets new precedents of stability in processing control. By measuring the *rate of change* of every disturbance at the very start and instantly reacting to meet the *maximum*, it brings smoother recovery . . *in as little as ¼ the usual time . . with as much as 50% reduction in the amount of upset!*

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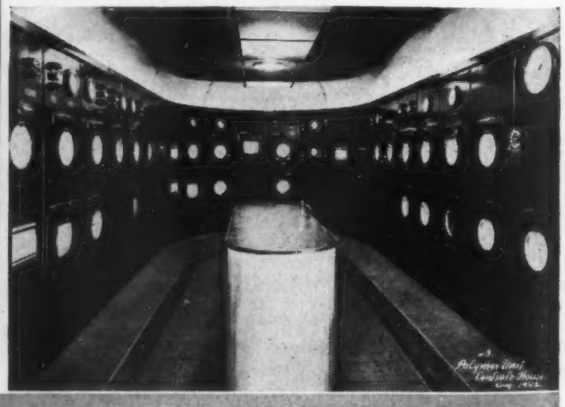
Polymer Unit Control House of a leading petroleum processer. One of many recent installations of Stabilog Controllers with HYPER-RESET.



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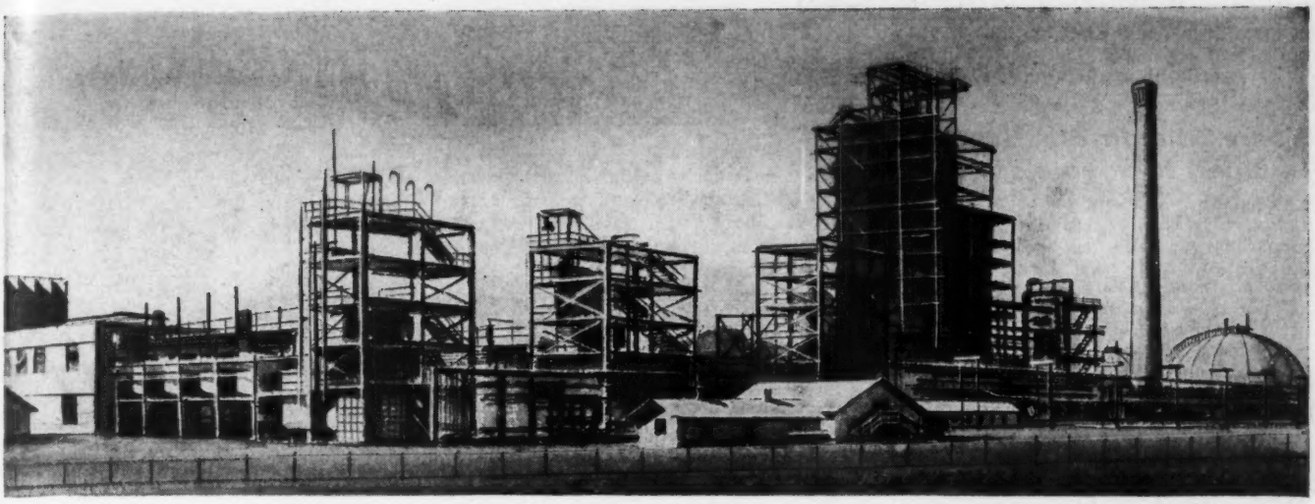
Controllers with HYPER-RESET



RUBBER "PLANTATION"...

...producing bumper wartime crops through aid of modern Super-Controls!

There's a world of difference between the pre-war tropical sources of natural rubber and the wartime synthetic rubber "plantations" now coming into production right within the United States. For, "cultivation" of synthetic rubber is a complex chemical process so exacting that every critical step must be minutely controlled by instruments of super-accuracy and sensitivity.

Since earliest experimental days of synthetic rubber development, Foxboro's famous Stabilog Controller has played a major part in maintaining the delicate balances of temperature, pressure and flow-rate required in this process.

At the very time when America's vast synthetic rubber program started, Foxboro research made available an additional unique refinement . . HYPER-RESET . . in this original stabilizing controller. Today, throughout the country's new synthetic rubber, aviation gasoline, and other war chemical plants, Stabilog Controllers with HYPER-RESET are providing stability *never even approached before* in process operation!

Write for Bulletin A-330 containing detailed information on Stabilog Controllers with HYPER-RESET . . the leading stabilizing controllers in wartime chemical processes. **The Foxboro Company, 74 Neponset Avenue, Foxboro, Massachusetts, U. S. A.** Branches in principal cities of United States and Canada.

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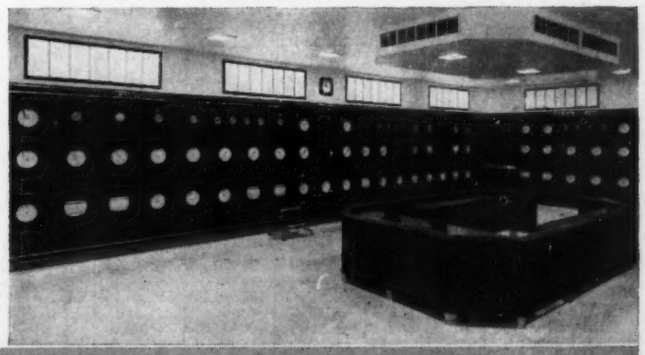
Typical installation of Stabilog Controllers and other Foxboro Instruments for complete, centralized plant control.



. . . . by FOXBORO

REG. U. S. PAT. OFF.

Distribution of WPB. Additional procedures for the presentation of the petroleum industry's requirements to WPB are still under discussion, and will be determined as soon as possible.

Valve Standardization Planned to Save Metal

A standardization program for all types of valves except those used on ships has been adopted by WPB, under which the number of varieties will be reduced from 4079 to 2504.

Valves to be produced in the future are classified in the order by design, by materials used, by pressure and by size. Cross valves and brass or iron angle check valves are to be eliminated, and pressure classes are reduced from 18 to 12.

The order will cut down the use of brass and steel for valve manufacture, WPB officials estimating that about 1900 tons of copper will be saved annually, together with about 4340 tons of alloy steel.

No brass valves in excess of two inches will be permitted. Steel valves in pressure classes of 150, 600, 900 and 1500 pounds are to follow specifications set forth by the American Standards Association or the American Petroleum Institute. For each pressure class, the order covers end flange faces, the materials for bodies and bonnets, seating materials for stems, bonnet bolting and bonnet bolt nuts. On valves of five inches or larger, the disc is to be of the same material as the body of the valve.

Iron valves of five pressure classes, from 25 to 300 pounds per square inch, and of 29 sizes from one fourth inch to 72 inches, are permitted under the order. On all types, end flanges are to conform to existing standards. Materials are specified for seating parts, bonnet bolts or studs, bonnet bolting and handwheels. Separate specifications are set up for gate valves, for globe, angle and cross valves and for check valves.

New Oil Fields Discovered in 1942 Fail By Substantial Total to Match Demand

New discoveries which may ultimately reach a maximum of possibly 800,000,000 barrels were made in 1942, the council was informed in a report by W. B. Heroy, PAW Director of Reserves, but even if that figure is reached only about 58 percent of the oil produced during the year will have been replaced.

The proven reserves of 335 new oil fields and horizons discovered in 1942 which were developed during that year are estimated at 178,420,960 barrels, while the estimated proven but undeveloped reserves in those fields and horizons, 241,147,652 barrels, give a total of proved reserves of 421,128,052 barrels, Heroy declared, but the possible maximum is placed at 800,858,629 barrels.

"The number of new fields found in 1942 is reported as 261, in comparison with 342 found in 1941," his report stated. "The proven oil reserves of these fields averaged 1,600,000 barrels per field and the possible maximum reserve was only about 3,000,000 barrels per field.

"The total crude-oil production of the United States for 1942 (one month estimated) was about 1,385,000,000 barrels, so that proven new discoveries were about 30 percent of the total production. If these new fields and new horizons should ultimately reach the estimated possible maximum they would still represent only about 58 percent of the amount produced."

Heroy explained that the "possible maximum" reserves represent an estimate which attempts to give an idea as to how much oil the 1942 discoveries may ultimately produce when fully developed, based largely on geological information as to the extent of the geological structures in which the discoveries were made.

Studying Costs

His report showed that the division of reserves is engaged in the preparation of an estimate by states of proven reserves, which will be completed about March 15; and is preparing estimates of materials required for exploration, including the requirements of geophysical crews, and is also working on information indicating the current volume of prospecting work and is studying the cost of exploration in the petroleum industry from the inception of search to the completion of a discovery well.

The report was one of several considered at a preliminary session of the PIWC production committee February 1, at which Don R. Knowlton, PAW Director of Production, forecast that only 16,000 wells would be drilled this year.

This, it was pointed out, would be slightly less than half the 32,300 wells drilled in 1941 and about 25 percent less than the 20,296 drilled last year.

"You will note that the production committees have estimated that a total of 20,846 wells will be drilled during the year," Knowlton said. "This is a substantial increase over the 16,000 wells which the production division estimated would be drilled. The production division's estimate was made on the basis of an estimated required daily average production of 3,800,000 barrels over the

Petroleum Reserves of the United States — New Discoveries, 1942

(Preliminary Estimate)

Figures Compiled by the Petroleum Administration for War

	NEW FIELDS DISCOVERED					NEW HORIZONS DISCOVERED					TOTAL DISCOVERIES				
		Estimated Ultimate Production					Estimated Ultimate Production					Estimated Ultimate Production			
District and State	No.	Proved Producing	Proved Undrilled	Total Proved	Possible Maximum	No.	Proved Producing	Proved Undrilled	Total Proved	Possible Maximum	No.	Proved Producing	Proved Undrilled	Total Proved	Possible Maximum
District I															
New York															
Pennsylvania															
West Virginia															
District II															
Illinois	42	12,174,250	5,640,250	17,814,500	22,815,000	7	2,860,000	1,810,000	4,670,000	6,020,000	49	15,034,250	7,450,250	22,484,500	28,835,000
Indiana	11	199,800	84,000	283,800	603,300	6	769,000	185,000	954,000	1,624,000	17	968,800	269,000	1,237,800	2,227,300
Kansas	31	10,478,805	32,550,000	43,028,805	73,333,805	6	4,115,000	1,940,000	6,055,000	7,055,000	37	14,593,805	34,490,000	49,083,805	80,388,805
Kentucky (West)	5	1,440,500	1,118,000	2,558,500	3,144,000						5	1,440,500	1,118,000	2,558,500	5,144,000
Michigan	15	3,477,800	2,512,900	5,990,700	11,833,000	3	107,500	380,000	487,500	1,485,000	18	3,585,300	2,892,900	6,478,200	13,318,000
Missouri															
Nebraska															
Ohio	1	78,000	312,000	390,000	1,425,000						1	78,000	312,000	390,000	1,425,000
Oklahoma	29	36,371,825	18,648,182	55,020,007	102,867,244	1	248,480		248,480	5,248,480	30	36,620,305	18,648,182	55,268,487	108,115,724
Total Dist. II	134	64,220,980	60,865,332	125,086,312	218,021,349	23	8,099,980	4,315,000	12,414,980	21,432,480	157	72,320,960	65,180,332	137,501,292	239,453,829
District III															
Arkansas	5	20,600,000	5,360,000	25,960,000	27,620,000						5	20,600,000	5,360,000	25,960,000	27,620,000
Louisiana	11	5,426,000	8,780,000	14,206,000	28,806,000	24	10,852,000	33,211,000	44,063,000	54,763,000	35	16,278,000	41,991,000	58,269,000	83,569,000
Mississippi															
New Mexico	5	880,000	2,310,000	3,190,000	6,040,000						5	880,000	2,310,000	3,190,000	6,040,000
Texas	99	49,861,000	92,896,000	142,757,000	223,447,000	19	7,316,000	18,992,000	26,308,000	59,208,000	118	57,177,000	111,888,000	169,065,000	282,655,000
Total Dist. III	120	76,767,000	109,346,000	186,113,000	285,913,000	43	18,168,000	52,203,000	70,371,000	113,971,000	163	94,935,000	161,549,000	256,484,000	399,884,000
District IV															
Colorado															
Montana	1	80,000		80,000	4,200,000						1	80,000		80,000	4,200,000
Wyoming	1					2	1,479,440	318,320	1,797,760	13,860,800	3	1,479,440	318,320	1,797,760	13,860,800
Utah															
Total Dist. IV	2	80,000		80,000	4,200,000	2	1,479,440	318,320	1,797,760	13,860,800	4	1,559,440	318,320	1,877,760	18,060,800
District V															
California	5	3,630,000	2,200,000	5,830,000	8,610,000	6	7,535,000	11,900,000	19,435,000	134,850,000	11	11,165,000	14,100,000	25,265,000	143,460,000
Grand Total—U. S.	261	144,697,980	172,411,332	317,109,312	516,744,349	74	35,282,420	68,736,329	104,018,740	284,114,280	335	178,420,960	241,147,652	421,128,052	800,858,629

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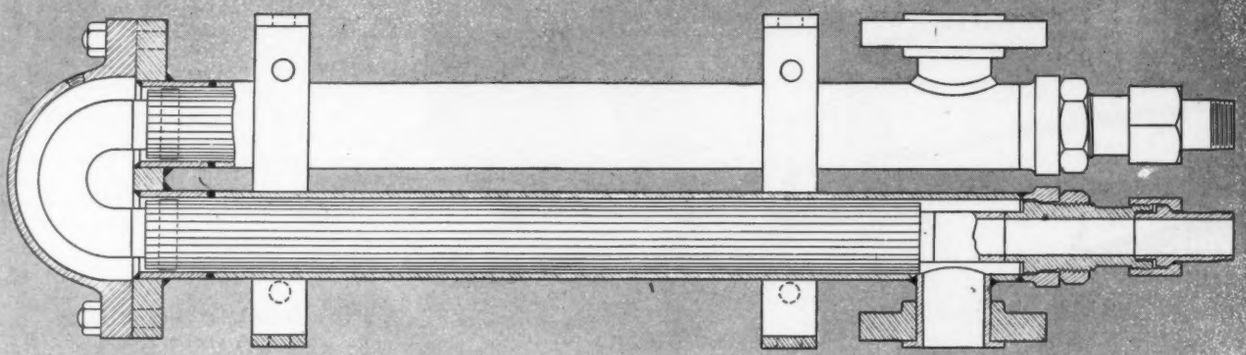

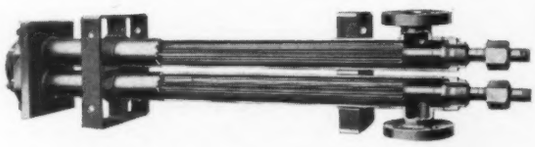

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year. Parenthetically, it is interesting to recall that only a month ago we heard assertions that there was not sufficient undeveloped area to justify the drilling of 16,000 wells.

"In view of the probable higher requirements for petroleum, and in view of the higher number of wells estimated by the production committees, the production division will reappraise the situation. We have already submitted to the War Production Board a request for steel to drill the 16,000 wells, and if our re-analysis warrants it, we will make a supplementary request to the War Production Board for an additional allotment of steel."

While development drilling may be further curtailed, if the division's estimate is closer than that of the committees, there will be an increase in exploratory drilling, it was shown in Heroy's report.

Heroy disclosed that a check of operations planned for 1943 is being made among a limited number of operators, and replies thus far received indicate that the number of wildcat wells which they will drill will be about 20 percent greater than the number drilled in 1942, the limiting factors being the ability of the companies to complete lease and title work, and the availability of drilling crews.

"Preliminary figures indicate that 3045 exploratory wells, drilled in search for oil and gas, were completed in 1942, in comparison with 3264 in 1941, a decrease of nearly 7 percent," he said. "There was a much greater decrease in the number of oil fields discovered, 261 in 1942 as compared with 342 in 1941, a decrease of about 24 percent."

In the production division's report, total completions for 1942 were set at 17,872, against 29,574 for 1941, or a drop of 39.6 percent.

The report disclosed that increasing difficulty is being encountered in securing alloy steel for sucker rods, and negotiations have been entered into with WPB looking to the development of a plan under which the industry might return its scrap alloy steel to the mills and secure an appropriate allocation of finished alloy steel in exchange.

A review of operations of the production branch of the industry in 1942, by the PIWC committee, gave the number of dry holes at 5512, or 31 percent of completions, against 7025, or 24 percent, in 1941.

Crude-oil stocks at the close of the year (after deducting for heavy California crude) were placed at about 234,000,000 barrels, a drop of 13,000,000 during the year.

In wildcat operations, 2536, or 83.8 percent of the 3029 wildcat wells drilled, were completed as dry holes, and only 493, or 16.2 percent, came in as producers, as compared with 2761 dry holes in 1941 which represented 84.6 percent of the completions.

Pleasure Driving Ban Saves 30,000 Barrels Daily

Approximately 30,000 barrels of gasoline daily are being saved as a result of the ban on pleasure driving, it was calculated this week by the OPA.

The relief given the fuel oil situation by the ban has convinced Administrator Prentiss M. Brown, who originally was skeptical, that it was a legal and the most logical move.

In the light of that conviction, it is doubtful whether OPA will be influenced by the PIWC recommendation for the lifting of the ban in April nor were there any indications that it would rescind last week's order cutting a second gallon of the value of heating-oil coupons in New England and New York, despite the criticism of the oil council. That cut, it is understood, was ordered over the protest of the PAW which believed that the situation then prevailing in the northeast could be cleared up within a few days.

In a move to ease a perplexing distribution condition, PAW has lifted the quota restrictions on withdrawals of fuel oils and kerosine from refinery and terminal supply points, believing that rations have been so synchronized with deliveries as to render the control unnecessary.

On a showing that West Virginia was producing more gasoline than it could consume or ship, OPA is restoring the valve of the motorist ration coupons in that state to four gallons and lifting the ban on non-essential driving. Earlier in the week the fuel-oil restrictions were removed from that part of Florida west of the Apalachicola River.

In line with previous agreements between Ickes and Nelson WPB on February 5 transferred to Ickes the administration of the L-56 and L-70 orders, governing the distribution of fuel oil and motor fuel, respectively.

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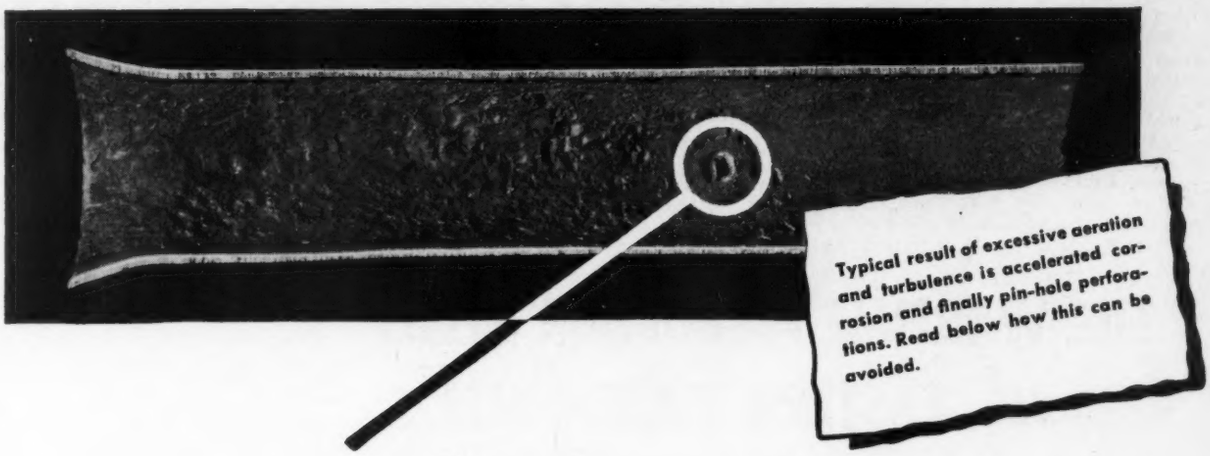
No. 2—how to prolong condenser tube life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THIS HOLE, CAUSED BY EXCESSIVE AERATION AND TURBULENCE, COULD HAVE BEEN AVOIDED

Finely divided air bubbles increase corrosion and the effect of turbulence. Worn packing on the pumps allows leakage of air into the water. The water level in the intake canal may be so little above the level of the suction pipe end that eddies form around the pipe and large quantities of air will be intermittently drawn into it. If the water is saturated with dissolved air, differences in pressure in the pump itself may liberate the air which has no chance to redissolve before passing into the tubes. In some places a long intake canal into a shallow tidal basin is impractical and in such cases the water may be pumped twice, once into a supply or surge tank on shore, then to the condenser in the usual way. If the surge tank is small the water pumped into it may be white with entrained air. If such water is circulated to the condenser, corrosion will certainly be rapid. The surge tank should be large enough so that baffles can be placed in it to quiet the water and allow the air to escape before it is pumped to the condenser.

The location of the sea chest on a ship, its size and the construction of the strainer have a marked effect upon turbulence which produces entrained air. Tube life can often be improved by increasing the size of the sea chest, by using a louvre type screen, with slats placed lengthwise to the water flow instead of a woven wire screen. Sharp edges of double plates can be filleted by welding to reduce turbulence. Even after all practical precautions have been taken there may be some air in the water.

If the water inlet of the condenser box is too narrow there may be great differences in water velocity due to eddies. Entrained air will collect in the quietest water, then pass through the tubes to cause failures in definite locations. If the condenser is a "double pass" with a horizontal web in the center, it will often help to drill a few holes in the web where pockets of air collect, thus by-passing some of the water and most of the air to the outlet water box.

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Council Warns Prompt Stabilization Is Needed to Avert Shortage of Oil

Warning that prompt action must be taken to stabilize the oil industry if the United Nations are to avert the possibility of a petroleum shortage which might affect the outcome, and certainly the duration, of the war, Petroleum Industry War Council at its February meeting recommended an advance of 25 cents per barrel in the ceiling prices on crude oil.

The report was immediately taken under consideration by Administrator Harold L. Ickes, who said that, while he had an "open mind" on the whole question, no time would be lost in making representations to OPA if his study convinced him of the need for a general increase.

The question of crude costs was one of three major subjects taken up by the council, which also went into the question of reserves as shown by discoveries last year and prospects for wildcatting in 1943 and again reviewed the East Coast situation.

All of the council's discussions were colored by the price problem, the economic committee's report on the Eastern situation developing that refiners in other districts have lagged in the adjustment of yields to produce more war products because of the financial problem, while prospecting operations for more than a year have been controlled to considerable extent by the price situation.

The East Coast situation now is in balance, to the extent that the deficiency in deliveries through the remainder of the winter can be met by withdrawals from stocks which, however, will be in a precarious position if the cold weather is unduly prolonged, the council was told in the monthly report of its committee on petroleum economics.

Through the prohibition on gasoline deliveries by tank car, the ban on pleasure driving and the cut in the value of heating-oil coupons, the daily deficiency of 200,000 barrels for the current quarter has been reduced to 72,000 barrels.

However, the actual experience may be even better, since the committee, in estimating receipts for the remainder of the quarter, did not give credit to the promise of J. J. Pelley, president of the Association of American Railroads, to increase rail movement to 900,000 barrels daily by the end of this month.

Commending the government for the restrictions it has imposed on the use of gasoline and oil, the committee noted that the same appreciation could not be expressed of the most recent cut of 11 percent in the value of fuel-oil coupons it said, is "unnecessary and inequitable in New England and New York which, to the consumers" in those areas.

The committee, next month, will submit a report covering the coming summer and next winter, at which time it will recommend the action to be taken to build up stocks so that the industry may go into the 1943-44 heating season with adequate supplies.

The report, however, carried one recommendation in advance of the close of the heating season—that the ban on pleasure driving be relaxed as quickly and as fully as possible.

Commenting on the steps taken to relieve the situation, the committee cautioned that "it should be borne in mind that, while the figures indicate that restricted demands can just barely be met when drawing stocks to critical minimums, this can only be achieved if the anticipated reductions in consumption and increases in supplies are realized and continued, at least through the first half of March.

"In any case," it said, "stocks over the remainder of the first quarter of this year will be at critically low levels, which means that, for the next six weeks, there will be no appreciable relief from the serious distribution difficulties now being experienced. Clearly every effort should be made to increase supplies above those forecast in order to relieve the situation."

To this end, it was declared, the transportation facilities released by restrictions on gasoline must be used for bringing in increased supplies of other products, and the prohibition on tank-car shipments of motor gasoline into District 1 should be continued through February and possibly March and, in addition, production of gasoline within the district should be kept to a minimum.

Particularly essential, it was pointed out, is an increased production of kero-

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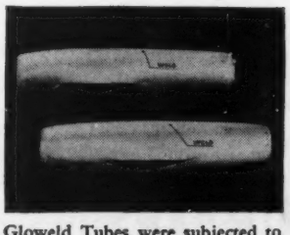

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sine and fuel oil by refineries in the district and, if additional tanker capacity can possibly be made available, additional deliveries by water.

"By the latter part of March," the committee forecast, "the situation should tend to become easier, but will be controlled by the severity of the winter and the extent of military demands upon District 1. Preliminary figures on supply and demand for the second quarter indicate that substantial additional supplies will be available for military requirements and the necessary rebuilding of stock levels, even though the severe restrictions on passenger-car use be relaxed within the limits of the unit values for passenger-car gasoline coupons. The extent of relaxation permissible on consumption restrictions will therefore be determined largely by the extent of military demand to be supplied during this period, on which information is not now available."

The committee endorsed the construction of the 20-inch products line approved last month by the War Production Board, but urged that it be carried to the coast without delay, declaring that if this is done before the end of the year "the whole situation will be much easier."

A survey indicated that the ban on pleasure driving has saved 36,000 barrels of gasoline daily and the fuel-oil restrictions have reduced consumption by 59,000 barrels.

In a study of the situation throughout the country as a whole, the committee expressed grave concern over conditions in Districts 1, 2 and 3, where operations are so out of balance that changes must be made at once.

"Characteristic of the situation in these three districts is the pronounced lack of residual fuel oil in relation to demand, with a tendency towards overproduction of light products, particularly gasoline," it declared. "This is especially noticeable in District 2 where, over the seven-week period December 5 to January 23, gasoline stocks have increased at the rate of approximately 130,000 barrels daily, and on January 23 were about 4,500,000 barrels greater than previously forecast as required for that date. Had yields been adjusted as previously recommended by this committee, the accumulation of gasoline could have been prevented, and badly needed crude oil or fuel oils would have been made available for shipment to District 1. As a result, East Coast supplies could have been increased by approximately one third of this excess gasoline accumulation, or by about 1,500,000 barrels, equivalent to about 30,000 barrels daily over the seven-weeks period, by virtue of supplies having been provided at nearer points than District 3 for tank-car movement to District 1."

Pointing out that in the past the committee has emphasized the importance of reducing gasoline yields in advance, to make available adequate fuel-oil supplies and prevent unnecessary gasoline-stock accumulations, the report charged flatly that the failure in general to adopt these recommendations has been partly responsible for the imposition of the ban on tank-car shipment of gasoline into District 1.

Price Adjustments

"Increasing residual fuel oil yields at the expense of gasoline obviously reduces refinery income," it was admitted. "The main deterrent to the making of the required yield changes has been the failure to provide the necessary price adjustments. The recent adjustments by OPA of residual-fuel-oil price ceilings on an API-gravity-premium basis in certain areas is a step in the right direction, but conditions in other areas will have to be taken into account if the overall situation is to be adequately corrected.

"The committee wishes to reiterate its view, embodied in its suggestion to the council in October, 1942, that the gravity-premium method is an effective incentive means for individual compensation for increased fuel-oil production, and feels that it should be further utilized in other areas than those designated by OPA in order to stimulate increased fuel-oil production where needed. However, to avoid inequities among customers, some arrangement should be made for a uniform average price to them, with reallocation of part of this price to suppliers, dependent upon the gravity supplied.

"The other noteworthy lack of balance occurring in the three districts is the maladjustment of refinery runs and yields as among the districts which is resulting in interference with the maximum output of essential war products. This situation is reflected in current failure to attain the maximum output of war products in Districts 1 and 3. In

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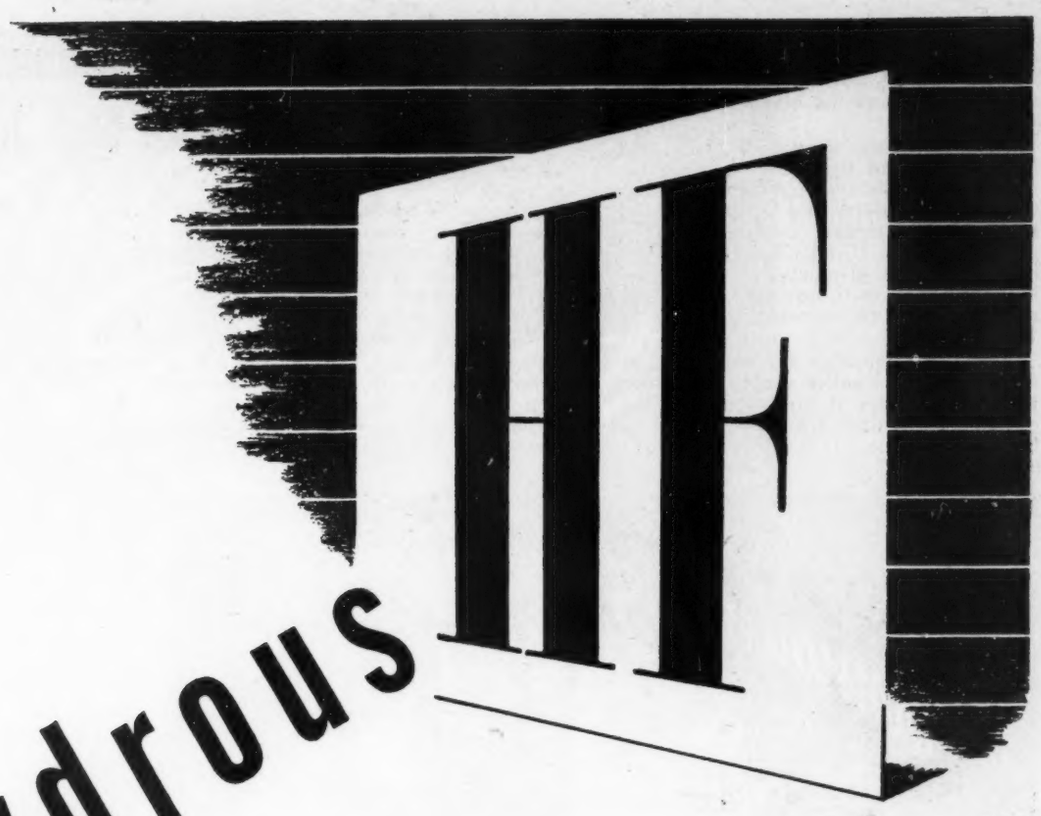

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District 1 this is due to insufficient crude supplies, while in District 3 it is due to lack of transportation for non-war products and the filling up of storage facilities."

However, it was disclosed, this matter is being studied by PAW with representatives of the refinery committees of the three districts, and is considering, among other things, the reduction of refinery runs in District 2, with a resulting shift from product to crude shipments to District 1, providing additional product outlet to refineries in Districts 1 and 3.

But, the committee warned, "prompt action on this or other adequate alternatives is necessary if further loss in the output of essential war products is to be avoided."

OPA Reads from Tariff Commission Report: "Crude-Price Advance Not Justified Now"

Taking quick advantage of the report on crude-oil production costs submitted by the Tariff Commission, the Office of Price Administration announced February 1 that "a general advance in crude-oil prices for the nation's oil production is not justified at this time."

But, it was added, "OPA has maintained and will maintain a sympathetic and open-door policy to any and all petitions for price adjustments, especially where abnormal conditions have resulted in hardship and uneconomic operation at present price levels."

A general increase in price, it was held, would add heavily to the consumers' fuel bill and dangerously threaten price control, since oil is a basic commodity in the domestic, industrial and military economy.

The Tariff Commission report, it was stated, indicates that continuation of present crude prices, including the special price increases already granted in some fields and for various areas, will enable the majority of producers to absorb any increases in production costs and maintain a margin of profit which must be considered adequate in wartime.

"There will be exceptions, which is true at any time," OPA said. "But to raise all prices to relieve the exceptional producer would disrupt the entire price structure of the petorleum industry and would not be justified by any evidence which has been put forward to date."

"Door Not Closed"

OPA officials estimated that for each cent per barrel added to the price of crude, the nation's fuel bill would be increased $14,000,000 per year. Last year, they pointed out, 1,385,000,000 barrels of oil were produced.

They stressed that their attitude toward a general increase "does not mean that the door has been closed against consideration of local, regional or area price problems arising from abnormalities, undue hardship arising from oil shortages, and uneconomic price structures."

They maintained, however, that "if there is a sound case for an over-all increase in price of crude petroleum such a case has not yet been presented. On the other hand, the extensive studies and surveys which have been made and recently published for OPA by the Tariff Commission clearly indicate that both the price of a barrel of oil and the margin of realization above cost of production are greater than in most recent years.

"This condition was shown particularly for the third quarter of 1942, when prices, costs and margins were very near the level of October, 1941, prices at which ceiling prices were established for petroleum and petroleum products under the Emergency Price Control Act of 1942."

OPA contendent that increased supplies of oil cannot always be obtained by means of price increase, and to support that position referred to the situation now prevailing in the East, where higher prices could have no effect in alleviating the shortage due to lack of transportation facilities.

"Both industry and the consuming public are fully aware that the job of OPA is to keep the cost of living at sane levels by safeguarding the public interest through discouraging inflationary trends," it was asserted in a formal statement. "In some known oil pools where abnormally low prices prevail, higher prices may be necessary to cover

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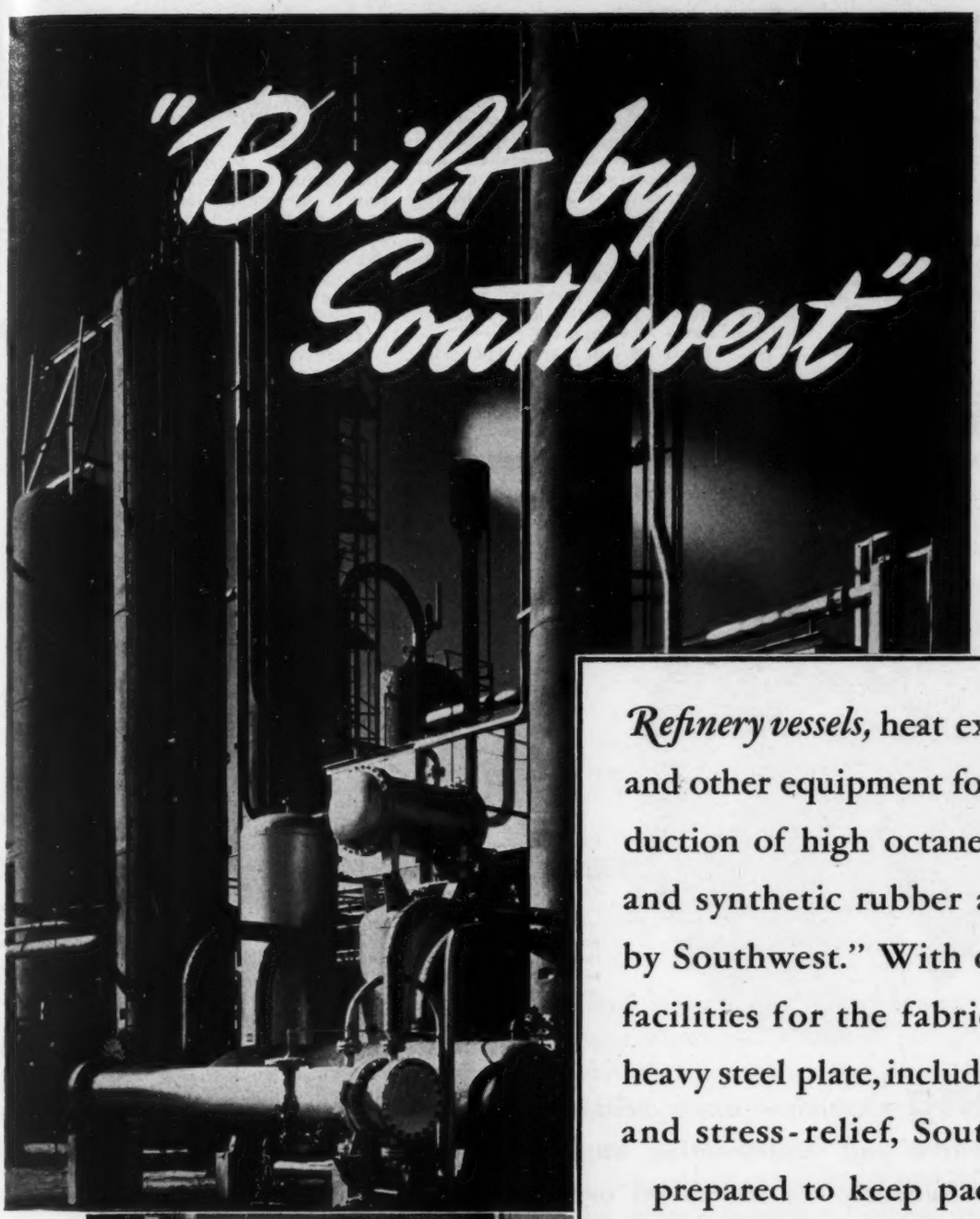

Refinery vessels, heat exchangers and other equipment for the production of high octane gasoline and synthetic rubber are "built by Southwest." With complete facilities for the fabrication of heavy steel plate, including X-ray and stress-relief, Southwest is prepared to keep pace with developments in refinery methods and practices.

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the costs of new drilling, and the agency is willing to make adjustments where they will result directly in bringing more oil to market to meet specific needs. But, it is contended, neither the public, the government nor industry can be further burdened with staggering oil bills simply because some producers are not realizing all of the profits they might have once enjoyed."

Ceilings in 1941

The Tariff Commission report, it was declared, showed a steady increase in crude prices until ceilings were established at October, 1941, levels and, it was added, "if price control had not been put into effect it is contended that prices would have continued to rise above reasonable levels."

While the commission's report on its survey of conditions in the second quarter of 1942 "indicates" that some reductions in margins took place in returns to crude producers, OPA held that the excess of price over cost was "still satisfactory."

"Another reason which has been advanced for a general increase in crude-oil prices—as much as 50 cents a barrel has been proposed—is to save the wells which are capable of producing only a few barrels a day," the statement continued. "These stripper and marginal wells have been an important part of the oil industry since the first years of the industry's development.

"Such wells are of many types and classifications and no uniform condition exists. The majority of these small producing wells are not now operated at a loss, nor could they produce much more oil if the price was doubled. Such wells are located throughout the oil producing states and it may well be that in some fields, in some areas and for some grades of oil for which there is great demand, a local price adjustment would serve good purpose in stimulating their rehabilitation and continued operation. But in few instances has a documented case been submitted to OPA classifying such stripper and marginal wells within a locality, district or area.

"The problem of current exploration or findings cost has been before the interested federal agencies handling petroleum matters for some time. These costs must be separated from direct crude-production costs, and investigations are now in progress by the various agencies to develop a solution for the problem but OPA has indicated in the past that it cannot properly be solved by a nation-wide increase in price, which would impose extraordinary price increases upon the consumer."

Buttram Brands Report Incomplete

Announcement of OPA will not influence the Independent Petroleum Association to abandon its fight for higher prices, it was declared February 3 by Frank Buttram, president.

The price administration, it contended, based its position on an "inconclusive and incomplete" report by the Tariff Commission, in which no consideration was given to 30 percent of the production and 50 percent of the wells, as of the period covered, and ignored 85 percent of the producers.

As against the findings of the commission, Buttram suggested that OPA weigh statistics issued by the Treasury showing that of 5569 corporations engaged in production in 1942, 3022 had a deficit of $61,169,000, and pointed out that Congressional committees investigating the problem have not agreed with OPA's views, and the Interstate Oil Compact Commission and authorities of several states have held that prices are too low.

"Any careful consideration of the situation leads to the conclusion that government must decide whether it will create a definite shortage of petroleum or permit crude price to resume a normal base to which it was returning when price ceilings were imposed," he asserted. "The OPA itself has said that the petroleum industry was in a depressed condition at the time the ceilings were made effective."

Value Questioned

Value and significance of the Tariff Commission's report were questioned in a statement by Russell B. Brown, general counsel of the Independent Petroleum Association of America, who declared that the report did not cover present day conditions and furthermore that it did not take into consideration certain oil-producing costs, especially interest on investment, which heretofore have been generally recognized as part of the cost of producing oil. Brown said it was unfortunate that the commission did not make the report as an independent agency but in collaboration "with an interested group which was the Office of Price Administration, whose repeatedly avowed purpose has been to keep prices stationary."

"It is assumed," stated Brown, "that

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—Lord Kelvin.

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American born Benjamin Thompson went to England in 1776, rose to important position in British foreign office, became Count Rumford.

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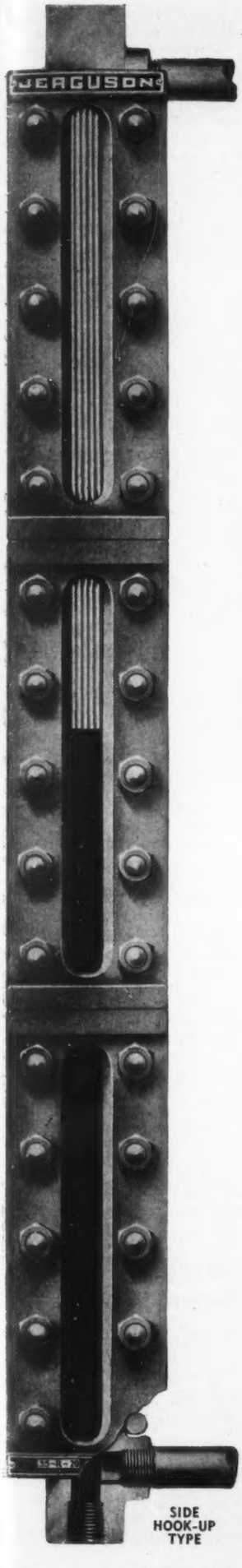

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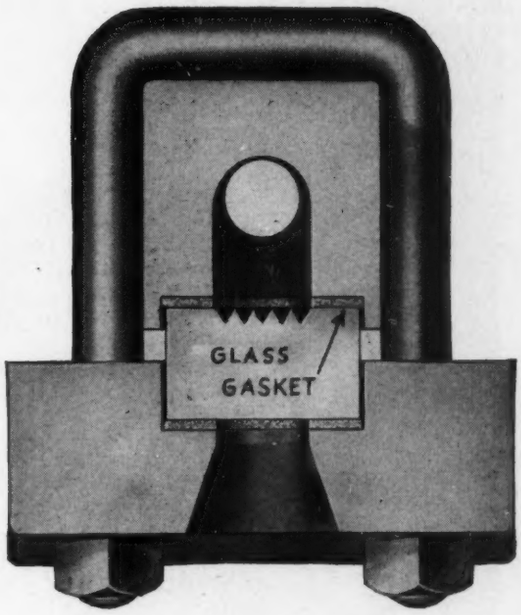

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2-JV-3

this (report) is the result of the survey announced by OPA in the latter part of 1941 as being made by the Tariff Commission in conjunction with OPA, to be used as a basis for determining proper price levels for crude petroleum throughout the United States.

". . . The first impression of the report indicates that while there are some 19,000 producers in the United States, they were able to obtain factual information from only 2534 producers, and that although there are only 2534 producers covered by this report, their total production amounts to 70 percent of the total production. This would indicate that the report covers companies of larger production. This is further emphasized by the fact that average daily production per well in the United States is 9.4 barrels and the average production per well for companies covered by this report is 13.7 barrels per well. This report covers periods for the calendar year 1939, 1940, and for the first, second, and third quarters of 1941; therefore it is historical in nature. There is no effort in the report to cover the cost of finding new reserves or to cover the replacement cost for oil sold.

"Certain trends are indicated which show that for the 60 largest producers reporting, the operating costs of production for the period from the second quarter of 1941 to the second quarter of 1942 had increased 16½ percent.

"Crude oil prices were frozen as of October, 1941. The most comprehensive portion of the Tariff Commission's survey ends with the third quarter of 1941. In any calculation of today's costs, September 30, 1941, is not a fair place to end a survey, whether it be on farming, producing oil, or setting the family table.

"Other important items that heretofore have been included by the Tariff Commission in similar studies and that have been generally recognized as essential to cost studies have been left out of this report. One such item is interest. Heretofore, the studies have provided for the interest on capital. This study makes no such provision. Most oil producers borrow money from time to time.

"The Tariff Commission, created as an independent agency, has been recognized as a fair and impartial agency. It is unfortunate that it did not make this study as an independent group . . ."

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Wartime troubles is the national 8-ball behind which many a manufacturer finds himself today. Priorities, restrictions, shortages of materials, transportation, and the urgent need for Super-Silvertop Steam Traps have helped to make uncertainties in the filling of orders. We believe it's safe to say that no manufacturer of traps can fill every order and ship when requested. For this reason we ask our customers to be as patient as possible and we'll do all we can to give you as many Super-Silvertops as we can when we can. Remember that we are doing our best under the imposed wartime limitations.

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Phillips Now Using Cycloversion Process

Phillips Petroleum Company has announced a new catalytic cracking process, designated Cycloversion, which is now in operation at one of its refining plants. Military secrecy leaves it unwise to give full details. However, it is credited with assuring greater quantities of essential ingredients for synthetic rubber and for explosives. The announcement carried this description:

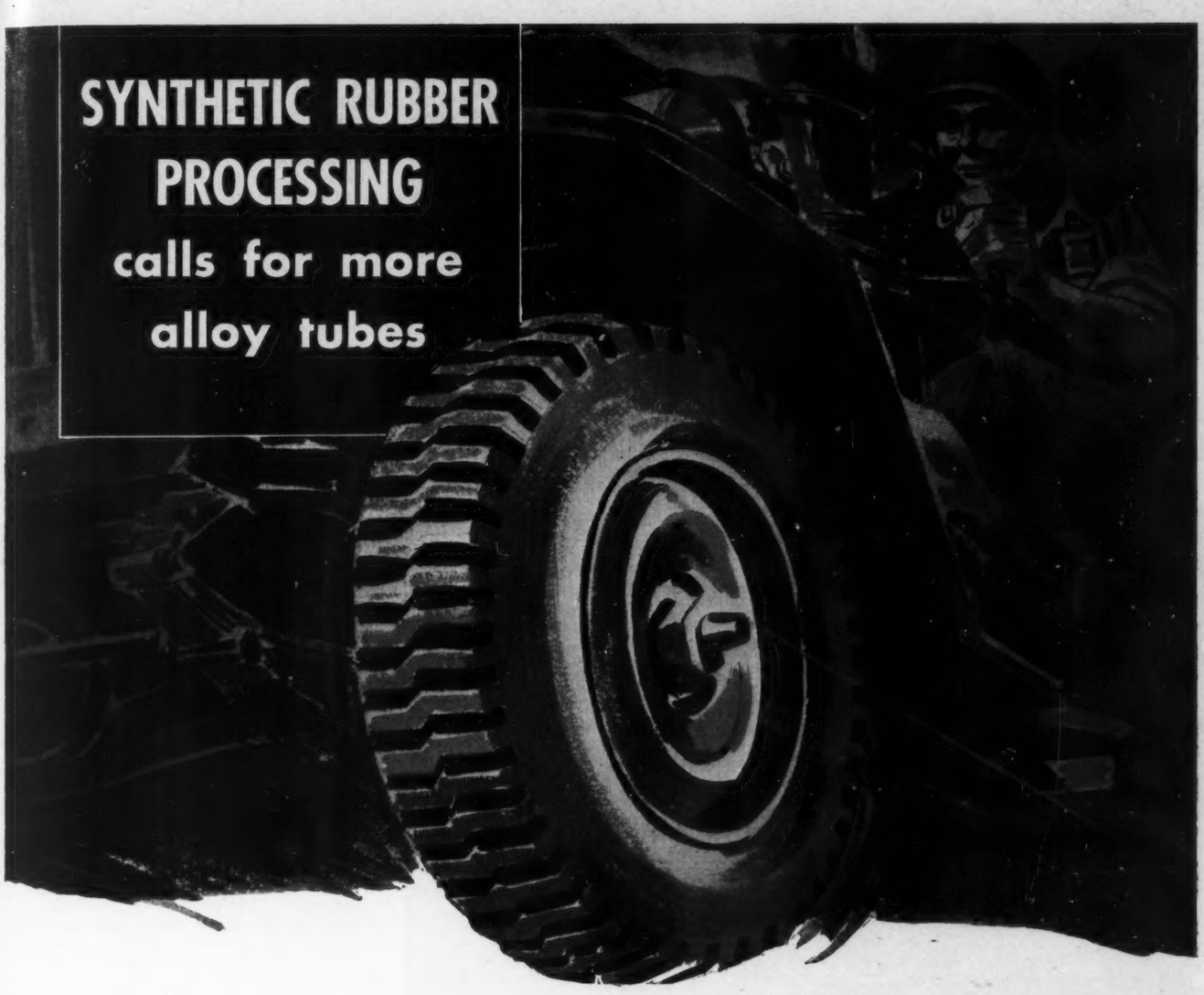
"In this catalytic conversion process, lower grades of automobile gasoline or other petroleum distillates are changed into a product having high percentages of aromatic hydrocarbons. This product has outstanding qualities and when blended with other aviation stocks greatly improves the flight performance of the finished aviation gasoline. The important application of this process is to increase production of 100-octane aviation gasoline, atlhough with this product it is feasible to build fuels which greatly exceed existing standards."

Company officials indicated that the process employs an inexpensive catalyst in fixed-bed reactors, and therefore only a minimum number of changes and a relatively minor quantity of critical materials are required to equip modern petroleum refining facilities to utilize the new development. The flexibility of the Cycloversion process, both in regard to type of feed stocks which it will successfully handle and to final products which can be manufactured by slight alterations in operating conditions, was pointed to by company officials as important under today's fast changing war conditions and for the post-war future.

Frank A. Watts to PWA Materials Division

Frank A. Watts, purchasing agent of Humble Oil & Refining Company, Houston, has been appointed director of the materials division of the Petroleum Administration for War. He succeeded Greer Orton, who returned to The Texas Company after completing the six months of service he agreed to serve when drafted to the position.

Watts is on leave of absence from the Humble organization, with which he has been connected since 1919.

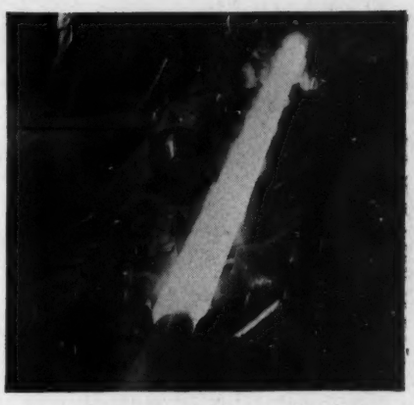


A NEW source of supply of seamless alloy steel tubing is now available for synthetic rubber plants. Tubular Alloy Steel Corporation, the latest name in Alloy Tubing, is geared especially to speed production on alloy tubes for war work. All the current alloys are being made in a modern equipped plant assuring the highest quality tubing available.

The question of what metals to use in making synthetic rubber is one where our metallurgists can be of great assistance to you. They have had experience in developing tubes for handling Butadiene and other ingredients used in the processing of synthetic rubber. In general the use of alloy steels is centered in furnaces where temperatures are higher than 1000°F. or where severely corrosive agents such as sulphur compounds and acids are present, and the proper selection from available alloys is extremely important.

The men making up Tubular Alloy Steel Corporation are thoroughly experienced in all phases of tube manufacture. They have the backing of 50 years of experience in research and engineering and have had an active part in the latest developments in all types of alloy tubing.

All sizes of round tubes from ¼" to 8⅝" are made in the customary wall thickness and in strict accordance with government specifications. Write for complete information.



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UNITED STATES STEEL

Treasury Expects Drop In Gasoline Tax Total

A sharp downward revision of Treasury estimates of revenue to be expected from goods and services affected by production restrictions and rationing orders was disclosed in the budget for the fiscal year to begin next July 1, submitted to Congress by President Roosevelt January 11.

As an example of the scaling-down, the yield from the gasoline tax during the current fiscal year, estimated last January at $385,400,000, is now estimated at $256,100,000 and for the fiscal year 1944 is placed at only $219,300,000. Actual collections in the fiscal year 1942 were $369,587,151.

The revenue from the tax on lubricating oils, however, last year estimated at $45,000,000 for the current year, now is figured at $57,800,000 and is expected to increase to $58,000,000 in 1944, compared with actual receipts in 1942 of $46,432,268. It was explained that while the automotive use of lubricating oils is expected to be curtailed, the effect on revenues will be more than offset by the increase in the tax rate from 4.5 to 6 cents a gallon under the 1942 tax act and by an increase in industrial use.

The estimate on revenue from the tax on pipe-line transportation this year was only slightly reduced, from $14,200,000 to $14,100,000, and is placed at $16,700,000 for 1944, compared with an actual of $13,474,822 in 1942.

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The $108,000,000,000 budget calls for a flat $100,000,000,000 for prosecution of the war, but no details of how the money is to be spent were given, partly to avoid giving information to the enemy and partly because possible material changes in war conditions make it desirable to withhold definite commitments. For the latter reason, no detailed estimates were submitted for the Petroleum Administration for War, Office of Price Administration, and Office for Emergency Management (WPB, etc.), but will be sent to Congress in the spring.

In one of the tightest departmental budgets submitted, Secretary Ickes slashed appropriations for the Interior Department wherever possible, cutting his total $19,000,000 under current funds.

Among the changes made were a reduction from $257,030 to $241,600 in the fund for the petroleum conservation division; an increase from $339,750 to $341,000 for the Geological Survey's enforcement of the mineral leasing act; and reduction from $368,100 to $335,000 in the Bureau of Mines' fund for oil and gas investigations and from $55,330 to $50,000 for its work on the hydrogenation of coal; the Bureau of Mines appropriation of $43,000 for synthesis of motor fuels was continued unchanged.

Less Fatty Oils in Domestic Greases

Manufacturers of lubricating greases are under instructions to reduce the amount of fatty oils in greases by substitution of fatty acids. The recommendation of PWA was for the purpose of providing more fats and oils for glycerine manufacture.

Deputy Administrator Ralph K. Davies pointed out that certain long-service, heavy-duty and high-temperature greases are excluded from the restrictions because grease made from fatty acids may not have the required service qualities. Greases purchased by the Army, Navy, and Office of Lend-Lease Administration, as well as those exported outside the United States, Canada and Alaska, are excluded for similar reasons. All other greases are to be made only with a percentage of the fats and oils formerly used, through the substitution of fatty acids.

On April 15, 1943, all lubricating grease manufacturers are required to file a report on the amount of fats and oils used and grease made during the first calendar quarter-year of 1943, with the director of refining of the petroleum administration. Similar reports will be due for each calendar quarter on the fifteenth of the month following each quarter.

Fact Sheet For Plant Protection

Through the Office of Civilian Defense, Washington, the fundamental background for setting up facilities and personnel in plant protection is available. The office has prepared a booklet, "Passive Protection for Industrial Plants," and a fact sheet, OCD Publication 5214, which is in explanation of the booklet.

A chart showing how duties of the personnel may be divided is a part of the fact sheet. In addition the duties of departments for plant protection are explained.

Higher Rating Given Materials for Repairs

Higher preference ratings for materials for field operations are granted the oil industry under an amendment to Preference Rating Order P-98-b, issued by the War Production Board on the recommendation of PAW.

Ratings of AA-1 now are assigned for materials to be delivered to operators for use in maintenance and repair operation or for use in alterations, which formerly carried a rating of AA-X or lower.

The amendment also provides that in cases of actual breakdowns, an operator can expedite delivery of materials by obtaining the counter-signature of his district office, if the item to be purchased costs less than $500.

In all other instances, however, and including actual breakdowns where an item costing $500 or more is needed, an operator cannot apply the AA-1 rating until he has received approval from the WPB Director General for Operations, through applications to PAW.

A rating of AA-2X or lower may now be applied to items costing less than $50 for use in research laboratories without a countersignature from a district office or approval from the Washington offices of either PAW or WPB.

An operator requesting approval to apply various preference ratings no longer will be required to name the supplier or suppliers from whom he expects to obtain the material, but may make his purchases wherever he wishes, once the rating is granted.

British Oil Mission Conferring in Washington

A British mission was in Washington this week at the invitation of the United States government, for consultation with the various agencies and other British missions concerned with oil and tanker questions.

Arrival of the mission was announced by Administrator Harold L. Ickes, who said it was headed by Geoffrey Lloyd, M. P., chairman of the British Oil Control Board and Petroleum Secretary, accompanied by F. C. Starling, director of petroleum supplies; T. H. Humphreys, director of the tanker division of the Ministry of War Transport, and Sir Frederick Godber, member of the trade control committee.

Ickes Contending for Full Gasoline Program

Suggestions by Under Secretary of War Patterson that the government requisition the spare tires of civilian motorists and also take 7,000,000 civilian cars were given the definite approval of Administrator Ickes February 4 as a means of getting rubber for military purposes.

Ickes position, however, was largely predicated upon the interference with his 100-octane gasoline program which would be offered if the plans of Rubber Director Jeffers were carried out in full.

The administrator made it plain that he was not satisfied with the decision of Stabilization Director Byrnes cutting both the gasoline and rubber programs, although he admitted that had he been in Byrnes position he could have reached no fairer conclusion, and said he would continue to fight for the full program which he had outlined, details of which, of course, could not be revealed because of their military importance.

Aviation gasoline, he said, should be one "of our primary objectives," but is not being produced in the quantities desired. While all military demands have been met, he disclosed that this was possible because the Army and Navy knew the situation and adjusted their requirements accordingly.

Whether the readjustments necessary to meet proposed new Army specifications raising the quality of gasoline above 100-octane would be justified in the light of existing conditions remains to be determined, he said. Inability to build plants on schedule, Ickes said, has been due to delays in getting priorities.

"If we had been allowed the priorities which we were allowed, at the time they were specified, the program would be in much better shape than it is today," he explained.

Recommendations of PIWC for relaxation of the Eastern ban on pleasure driving met with little sympathy from the administrator, who declared his first interest was in making sure that people do not have to go cold next winter.

Instead of relaxation, he said, the ban should be extended over the entire country, with the exception of the producing states where there are available stocks that cannot be moved to the East.

Oil stocks in the East are still going down, he said, and railroad deliveries during the week ended January 30 were only 2000 barrels daily above the previous week.

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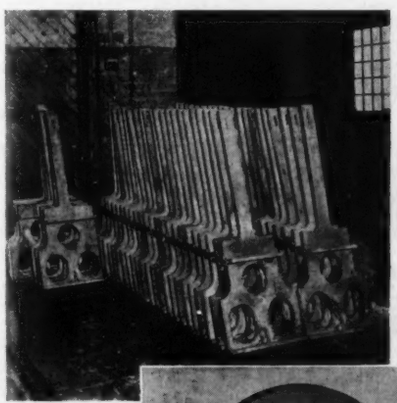

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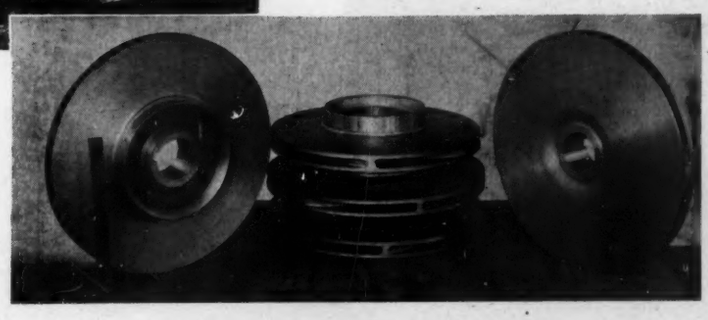

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2 DU 4

DIGEST OF UNITED STATES PATENTS

Newer Patents on Catalytic Polymerization

Compiled by
HEINZ HEINEMANN, The Attapulgus Clay Co., Philadelphia

U.S.P. 2,220,930. Polymerization of Hydrocarbons. Ch. A. Kraus to Standard Oil Development Company.

Olefin hydrocarbons are contacted at a temperature not higher than room temperature with a compound of the formula MX_mR_n where M is aluminum, gallium or boron, X a halogen and R a monovalent hydrocarbon radical, m and n each represent an integer from 1 to 2 and $m+n=3$. Dimethyl aluminum chloride may be used for this purpose. Rubber-like polymers having molecular weight of at least 1000 are obtained when a temperature of less than —50° C., like —78° is used in the treatment of isobutylene.

U.S.P. 2,222,304. Method and Apparatus for Catalytic Reaction. Th. P. Simpson, J. W. Payne and J. A. Crowley to Socony-Vacuum Oil Company.

Hydrocarbon gases are polymerized to gasoline in a cyclic operation at temperatures not substantially in excess of 350° F. and the catalyst used is regenerated in situ at temperatures not substantially below 600° F. The temperature of both reactions is controlled by means of a fluid heat-exchange medium maintained at the temperature of the controlled reaction. To quickly change the temperature from reaction to regeneration proceduce one heat-exchange medium is withdrawn while the other is admitted at the temperature of the proposed step.

U.S.P. 2,226,562. Production of Liquid Polymers. E. J. Houdry to Houdry Process Corporation.

A fresh charge of the hydrocarbon gases to be polymerized is sent under reaction conditions to a primary polymerization zone, the formed liquid polymers are then removed and the remainder of the stream under treatment is sent to a second polymerization zone. At least a part of the products of this second zone is added to the stream leaving the primary polymerization zone before the removal of the liquid polymers. A final removal of liquid polymers is effected from those products of the second zone which are not returned to the first zone. The then remaining gases are sent under reaction conditions to a dehydrogenation or gas-cracking zone to convert them at least partly into unsaturates which are added to the fresh charge. The ratio of recycled to unrecycled hydrocarbons introduced into the second polymerization zone may be within the range of from .5:1 up to 5:1 and polymerization in both zones is preferably effected in the liquid phase and at a temperature not exceeding about 300° F.

U.S.P. 2,228,131. Treatment of Hydrocarbons. K. M. Watson to Universal Oil Products Company.

Olefinic gases are subjected to polymerizing conditions in contact with a solid catalyst and the gas is removed from contact with the catalyst after a time of about 15 to 40 seconds. The relatively heavy polymerization products which form a mist under polymerizing conditions are then separated from the gas and the latter is subjected to further treatment with the solid catalyst for a further time of contact like 60 to 75 seconds. A precalcined mixture of phosphoric acid and a siliceous adsorbent may be used as the catalyst. The heavy polymers can be removed by electric precipitation. Temperatures of 350° to 500° and pressures of about 100 to 300 pounds may be maintained during the first polymerization period.

U.S.P. 2,230,648. Conversion of Hydrocarbons. E. T. Layng to The Polymerization Process Corporation.

Olefinic hydrocarbons are converted to hydrocarbons of higher boiling points by contacting them at elevated temperatures with catalytic material which comprises mercury pyrophosphate as an essential ingredient. A mixture of this compound with a pyrophosphate of Cu, Zn, Mg, Fe, Co, or aluminum may also be used.

U.S.P. 2,230,461. Conversion of Hydrocarbons. V. Komarewsky to Universal Oil Products Company.

Aromatic hydrocarbons like benzene are formed by contacting gaseous olefins like ethylene at polymerization temperature with a granular catalyst which comprises phosphoric acid and a metal of the eighth group of the periodic system, like e.g., a mixture of liquid orthophosphoric acid, nickel and nickel oxide.

U.S.P. 2,228,669. Polymerization of Olefins. S. H. McAllister to Shell Development Company.

Olefin containing hydrocarbons are contacted in the liquid phase with a strong polybasic inorganic acid under polymerizing conditions. A part of the hydrocarbon layer, containing unreacted olefin is agitated with said acid for at least ten minutes at a temperature below that at which substantial olefin polymerization takes place. The resulting mixture is separated into a hydrocarbon phase containing the higher-boiling hydrocarbons and an acid phase. At least a part of this acid phase is used for carrying out the polymerization. Sulfuric acid of about 50 to 85 percent may be used at about 10° to 50° C. during the first or absorption period whereas the temperature during the polymerization period which extends for about 1 to 15 minutes is from 70° to 125°.

U.S.P. 2,231,231. Process and Apparatus for Catalytic Operations. P. Subkow to Union Oil Company of California.

Unsaturated hydrocarbons are heated to an elevated temperature and then passed in a stream through a reaction zone while a granulated polymerizing catalyst is introduced into this zone and moving countercurrently to the hydrocarbons. The velocity of the hydrocarbons is sufficiently high to maintain the catalyst in suspension. Poisoned or at least partially inactive catalyst is withdrawn from the reaction zone and separated from the polymerized material, then regenerated. The catalyst used may be a dehydrogenation catalyst or a polymerization catalyst like trivalent

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metalhalides, sulphuric or phosphoric acid or their salts, etc.

U.S.P. 2,233,951. Process of Producing Low-Boiling Hydrocarbons. Morris Levine to Danciger Oil & Refineries, Inc.

Gaseous olefinic hydrocarbons are heated in their reaction zone in contact with nitrosyl chloride and at a temperature sufficiently high to effect polymerization of the gaseous hydrocarbons to low-boiling liquid hydrocarbons. A promoter such as aluminum oxide or bauxite, ZnO, SnO or an alkaline earth as preferably added to the catalyst. The temperature range is from 100° to 400° F.

U.S.P. 2,230,978. Conversion of Hydrocarbons. E. T. Layng to The Polymerization Process Corporation.

An olefin-rich hydrocarbon mixture is treated with catalytic compositions containing as an essential ingredient a metal pyrophosphate such as copper pyrophosphate, capable of reduction to an active compound which is a polymerization catalyst. The catalytic material is maintained in a reducing atmosphere other than the olefin-rich hydrocarbon mixture at elevated temperature for a time sufficient to effect reduction of a portion of the metal pyrophosphate to the active modification. Then the olefin-rich mixture is passed over said activated catalytic composition at an elevated temperature not substantially exceeding 600° F.

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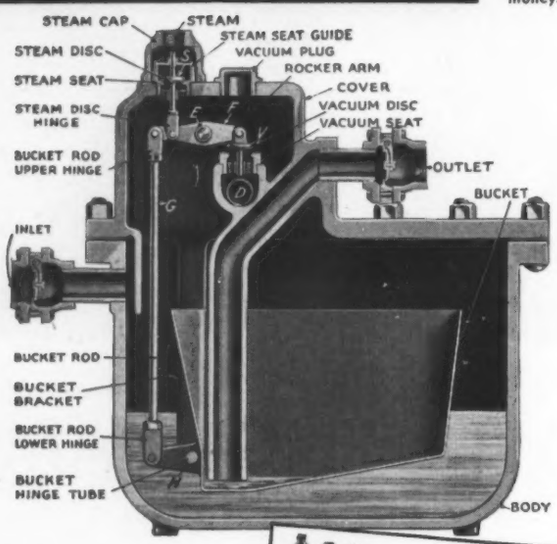

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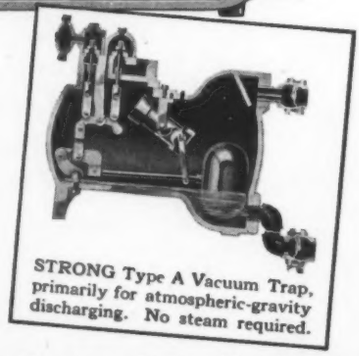

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U.S.P. 2,234,177. Conversion of Olefin Hydrocarbons. E. R. Kanhofer to Universal Oil Products Company.

Gaseous olefins are continuously passed through a bed of solid catalyst such as a calcined mixture of a phosphoric acid and a silicous material which is maintained at optimum polymerization temperature for the major part of the run. The optimum temperature shall be in excess of that at which there would be sufficient condensation of polymer gasoline to wash and clean the catalyst bed of heavier hydrocarbon material formed during the polymerization. Periodically, however, the temperature of the catalyst bed is lowered for relatively short intervals to about 225° F. for condensing polymer gasoline on the catalyst bed and washing heavier hydrocarbon material from it.

U.S.P. 2,237,459. Polymerization of Olefins. R. B. Thompson to Universal Oil Products Company.

Normally gaseous olefins are converted into normally liquid hydrocarbons of gasoline boiling range by subjecting them to contact with sulfamic acid or a composite of this acid with a substantially inert adsorbent like silica gel. Reaction conditions are 150° to 350° and 100 to 2000 pounds.

U.S.P. 2,237,822. Conversion of Hydrocarbons. E. T. Layng to The Polymerization Process Corporation.

Olefinic hydrocarbons are converted into hydrocarbons of higher boiling points by contacting them at elevated temperatures with a catalyst comprising as an essential ingredient one of the following acid metal pyrophosphates: $CuH_2P_2O_7$, $HgH_2P_2O_7$, $ZnH_2P_2O_7$, $MgH_2P_2O_7$, $Fe_2H_6(P_2O_7)_3$, $Al_2H_6(P_2O_7)_3$.

U.S.P. 2,242,771. Method of Operating Polymerization Plants. H. J. Baker, Jr., and W. Mendins to Sinclair Refining Company.

A heated gaseous mixture containing a substantial amount of normally gaseous higher olefins is passed over a catalyst at a temperature not substantially in excess of about 550° F. The obtained product is stabilized and the stabilizer product is condensed to form a liquid product and a composite gaseous product which is lean on high olefins. A controlled portion of the gaseous product is returned to the catalyst. A predetermined concentration of higher olefins is thus maintained in the reaction zone. The pressure of the stabilizer should be higher than that of the reaction zone.

U.S.P. 2,243,470. Production of High Molecular Weight Polymers from Iso Olefins and Halogenated Derivatives of the Polymers. A. J. Morway and F. L. Miller to Standard Oil Development Company.

Isobutylene is polymerized at a temperature below —10° C. in the presence of a saturated aliphatic halide solvent with less than 3 carbon atoms such as carbon tetrachloride with a volatizable Friedel-Crafts halide such as boron fluoride serving as a catalyst. An inert normally gaseous refrigerant such as dry ice can be added and the resulting polymer solution may be halogenated by free halogen under the influence of the aliphatic halide present.

U.S.P. 2,245,143. Treatment of Olefin Hydrocarbons. C. G. Gerhold to Universal Oil Products Company.

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¾	16
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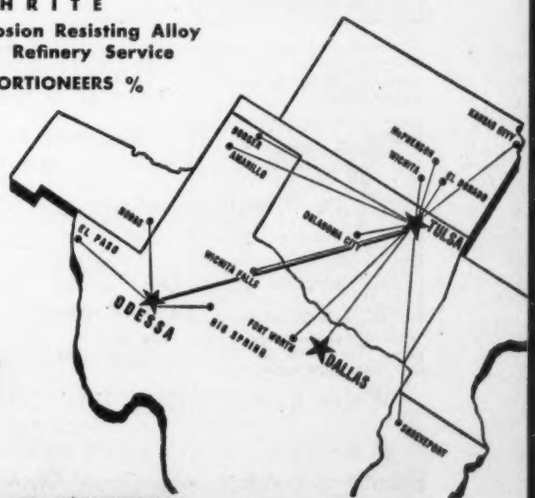

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a hydrated catalyst which tends to deteriorate due to hydration under operating conditions sufficient quantities of aqueous fluid to substantially prevent loss of water are added at certain points. The catalyst preferably comprises solid phosphoric acid and contains water.

U.S.P. 2,251,580. Conversion of Olefinic Hydrocarbons. R. F. Ruthruff to Chempats, Inc.

To convert them into higher-boiling hydrocarbons, olefinic hydrocarbons are contacted at elevated temperatures with a catalyst which comprises as an active ingredient an adsorption complex of phosphoric acid on hydrous stannic oxide. This catalyst is prepared by dissolving 200 g sodium meta stannate in 2500 cc of water and treating this solution with 40 cc of 85 percent orthophosphoric acid. The catalyst is precipitated by slowly adding to the mixture an acid such as concentrated nitric acid.

U.S.P. 2,254,522. Conversion of Hydrocarbons. C. G. Gerhold to Universal Oil Products Company.

Gaseous olefins are polymerized in the presence of sulfuric acid at elevated temperatures and pressure to form a polymer which contains dissolved gases and sulfuric acid esters. This liquid is reboiled by steam introduction and the gases are thus removed while the esters remain unchanged. The hydrolization of these esters is effected by a further treatment of the liquid with steam in the presence of alkali.

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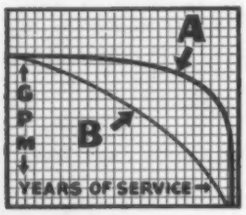

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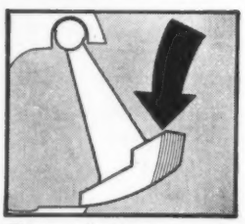
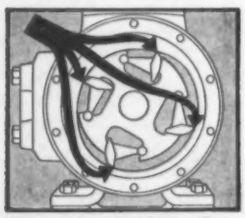
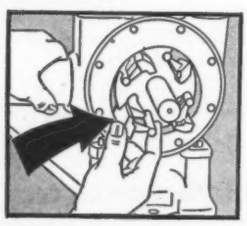


This much can wear away, without affecting the capacity of the pump.



Wear is confined to these points: the tips of the "buckets" (swinging vanes).



When finally worn out, the "buckets" are replaced (a 20-min. job) and pump is restored to original efficiency.

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"BUCKET DESIGN"—SELF-ADJUSTING FOR WEAR

U.S.P. 2,255,275. Polymerization of Refinery Unsaturates and Preparation of Improved Motor Fuels. E. E. Stahly to Standard Oil Development Company.

High-octane motor fuel is produced from an olefin mixture which essentially comprises propylene and at least one other olefin of higher molecular weight but does not contain constituents with more than five C-atoms. This mixture is contacted with 55 to 75 percent sulfuric acid at 175 to 300° F. and under elevated pressure. The reaction product which predominantly boils within the gasoline range and contains a minor amount of isopropyl ether is separated from the sulfuric acid. The constituents of the reaction product are separated by fractionation. The double bonds in the hydrocarbon fraction are then hydrogenated. Nickel may serve as a catalyst if the liquid is free of sulphur. The hydrogenated product may be combined with the fraction containing the isopropyl ether.

U.S.P. 2,259,754. Conversion of Hydrocarbons. E. T. Layng to The Polymerization Process Corporation.

Olefinic hydrocarbons are converted to hydrocarbons of higher boiling point by contacting them under suitable conditions of temperature, pressure and time with copper pyrophosphate. The latter is prepared by the reaction of a soluble copper salt, such as $CuSO_4.5H_2O$ and a soluble pyrophosphate such as $Na_4P_2O_7.\ 10H_2O$ in an aqueous solution wherein the ratio of copper salt to pyrophosphate is at least equal or greater than the stochiometric ratio of these compounds. The thus prepared copper pyrophosphate is free of the double salt of copper pyrophosphate and soluble pyrophosphate and it is claimed to have a materially shorter induction period than a copper pyrophosphate catalyst prepared with an excess of soluble pyrophosphate.

U.S.P. 2,262,804. Catalyst. J. W. Jean.

A catalyst for polymerizing gaseous olefins is prepared by mixing sulfuric acid and a sulfuric acid reactive absorbent material comprising a mixture of a porous carrier, iron oxide, lead oxide and borax. A hard, friable and porous acid-reacting mass is formed.

U.S.P. 2,263,266. Process of Manufacturing Motor Fuel. W. E. Forney to Cities Service Oil Company.

A high-anti-knock motor fuel is produced from a hydrocarbon mixture containing substantial proportions of olefinic hydrocarbons by intimately contacting this mixture with phosphoric acid at temperatures between 300 and 475° F. and preferably at 375° and superatmospheric pressure. A part of the reaction products is condensed under the operating conditions and is withdrawn from the reaction zone as a liquid oil which is washed with an alkaline solution and blended with a low-octane fuel. The phosphoric acid is preferably used in concentrated form and may contain a substantial proportion of alkyl phosphates.

U.S.P. 2,267,737. Treatment of Hydrocarbons. V. N. Ipatieff and V. Haensel to Universal Oil Products Co.

The polymerization of olefins is achieved by contacting them with a catalyst comprising essentially a com-

plex formed by the interaction of dioxane and sulfuric acid. This catalyst is suitably supported by a relatively inert carrier. It can be prepared by first adding a definite quantity of dioxane to the carrier which may be either alumina or Kieselguhr and then slowly adding a definite quantity of 100 percent sulfuric acid. The solidified mass is then broken into particles of suitable size. The polymerization using this catalyst takes place at from 32 to 175° F. and under a pressure from atmospheric to 1000 pounds per square inch.

U.S.P. 2,266,019. Hydrocarbon Conversion and Polymerization. F. E. Frey to Phillips Petroleum Co.

Predominantly paraffinic normally liquid hydrocarbons, a majority of which boil in the motor-fuel range are produced from a normally gaseous hydrocarbon mixture, containing at least 10 percent of simple unsaturated hydrocarbons and at least 50 percent of paraffinic hydrocarbons having at least 3 carbon atoms per molecule by continuously passing this mixture under a pressure in excess of 2000 pounds first through a heating zone of restricted cross section where the mixture is rapidly heated to a temperature below reaction temperature but sufficient to sustain the reaction temperature in the subsequent exothermic reaction. The thus heated mixture is then passed through a passageway which is sufficiently restricted to impart it a linear velocity in excess of 40 feet per second and is introduced into an enlarged reaction chamber in such a manner as to maintain therein a high degree of circulation and turbulent mixing. A temperature of between 700 and 1100° F. is maintained in this chamber without substantial addition of heat. The reactants remain in this chamber under the indicated conditions for an average period of from 1.5 to 7.5 minutes.

U.S.P. 2,268,618. Polymerization of Hydrocarbons. R. Pyzel and C. G. Gerhold to Universal Oil Products Company.

Octenes are produced by cross polymerization of iso and normal butenes by introducing the butenes into a polymerization zone which contains solid phosphoric acid as a catalyst. The reaction is initiated at 230 to 365° F. and the polymerization zone is in heat exchange with a normally liquid cooling medium of constant boiling point. Water is preferably used for this purpose and it is maintained at its boiling point by the heat from the exothermic polymerization reaction. The boiling temperature of the water of other liquid upon which the temperature in the reaction zone is dependent is adjusted by controlling the pressure exercised on the cooling medium. The temperature of the reaction zone is thus prevented from rising appreciably above 420° F.

U.S.P. 2,271,942. Process for the Polymerization of Gaseous Olefins. E. Keunecke and H. Grasshof to W. E. Currie.

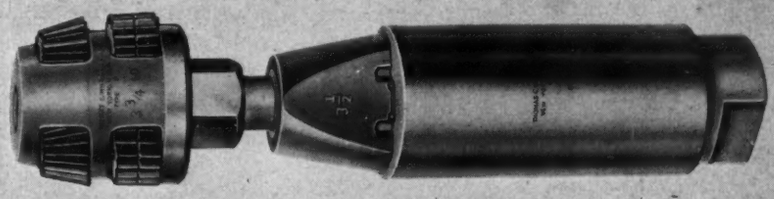
Liquid hydrocarbons are produced from gaseous olefins by contacting the gases at polymerization temperature with a solid catalyst which essentially comprises a composition of a salt of a metal of the second group of the periodic system, such as calcium, and an acid of phosphorous together with a free acid of phosphorous in a ratio approximately corresponding to 1 mol proportion of the primary orthophosphate to from .5 to 1 mol proportion of orthophosphoric acid. This catalyst may be prepared by heating a primary, secondary or tertiary phosphate of one of the metals in question with phosphoric acid in such proportions as to obtain a product of the indicated content.

U.S.P. 2,277,819. Catalytic Hydrocarbon reactions and Catalysts the refor. W. G. Craig to J. W. Jean.

Gaseous hydrocarbons containing olefins are subjected to the action of a solid catalyst composed of sulphuric acid and phosphoric acid, buffered by boric acid and cemented by a metal sulphate such as aluminum sulphate. The catalyst can be supported by a solid carrier and the reaction is preferably carried out at 200 to 400° F. and elevated pressure. Liquid hydrocarbons suitable for motor fuel are obtained.

U.S.P. 2,276,893. Polymerization of Olefins to High-Molecular-Weight Hydrocarbon Polymers. R. M. Thomas and I. E. Lightbown to Standard Oil Development Company.

A Friedel-Crafts catalyst such as aluminum chloride is dissolved in a low molecular organic solvent such as an alkyl halide solvent, at a temperature not substantially below room temperature and the obtained solution is cooled to at least —40° C. The cooled solution is then atomized and dispersed into a polymerizable liquid. This latter



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liquid contains as a main constituent a low molecular weight iso-olefin reactant, such as 70 percent by volume of liquid iso-butylene. It may also contain about 30 percent of liquid butadiene and may be diluted with 100 to 200 percent by volume of liquefied normally gaseous hydrocarbon. Under other conditions the reaction temperature may only be —10° C. Linear hydrocarbon polymers having a molecular weight above about 1000 are obtained by this process.

U.S.P. 2,277,938. Process for Reforming and Polymerizing Hydrocarbons. P. Subkow to Union Oil Company of California.

Reformed polymer gasoline is produced by passing a stream of vaporized petroleum stock through a cracking zone into a polymerization chamber where gaseous hydrocarbons formed in the cracking zone are polymerized. An oxygen containing gas is passed with the reactant vapors through the cracking zone and polymerization chamber to remove diolefins and other gum-forming constituents. A finely divided catalyst is preferably carried in said vaporized stream of hydrocarbons while flowing through the cracking zone and another catalyst is added in the polymerization chamber after removal of the cracking catalyst.

U.S.P. 2,283,499. Catalytic Process. K. H. Hachmuth to Phillips Petroleum Company.

The process aims to prolong the life or activity of such polymerization catalysts which under polymerization conditions tend to promote the formation on the catalyst of a deleterious carbonaceous deposit, as in the case of silica-alumina catalysts. The granular catalyst is graded as to size and deposited in a vertically arranged polymerization chamber in such a manner that finer particles are at the bottom and coarser particles at the top. An olefin-containing hydrocarbon mixture is passed down through this mass of catalyst in the chamber under suitable polymerization conditions of heat and pressure.

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Institute Revises Its Methods for Testing

The Institute of Petroleum, Imperial College of Science and Technology, Prince Consort Road, London, S. W. 7, has published its fourth edition of "Standard Methods for Testing Petroleum and Its Products (fourth edition 1942)," price $3.00. The volume consists of 400 pages and includes 97 diagrams.

The new edition represents a thorough revision of the majority of the methods described in the Third Edition and all those which have been published in the Journal of the Institute since 1935.

All methods have been rewritten, incorporating improvements developed since their last publication. Special attention has been given to the adoption of the International Standard definitions of accuracy, precision and tolerance.

An attempt has been made to include all test methods which are required in official specifications, and particularly those of the Services. For example, the oxidation test required for aircraft lubricating oil to the (British) Ministry of Aircraft Production specification is now published in detail for the first time.

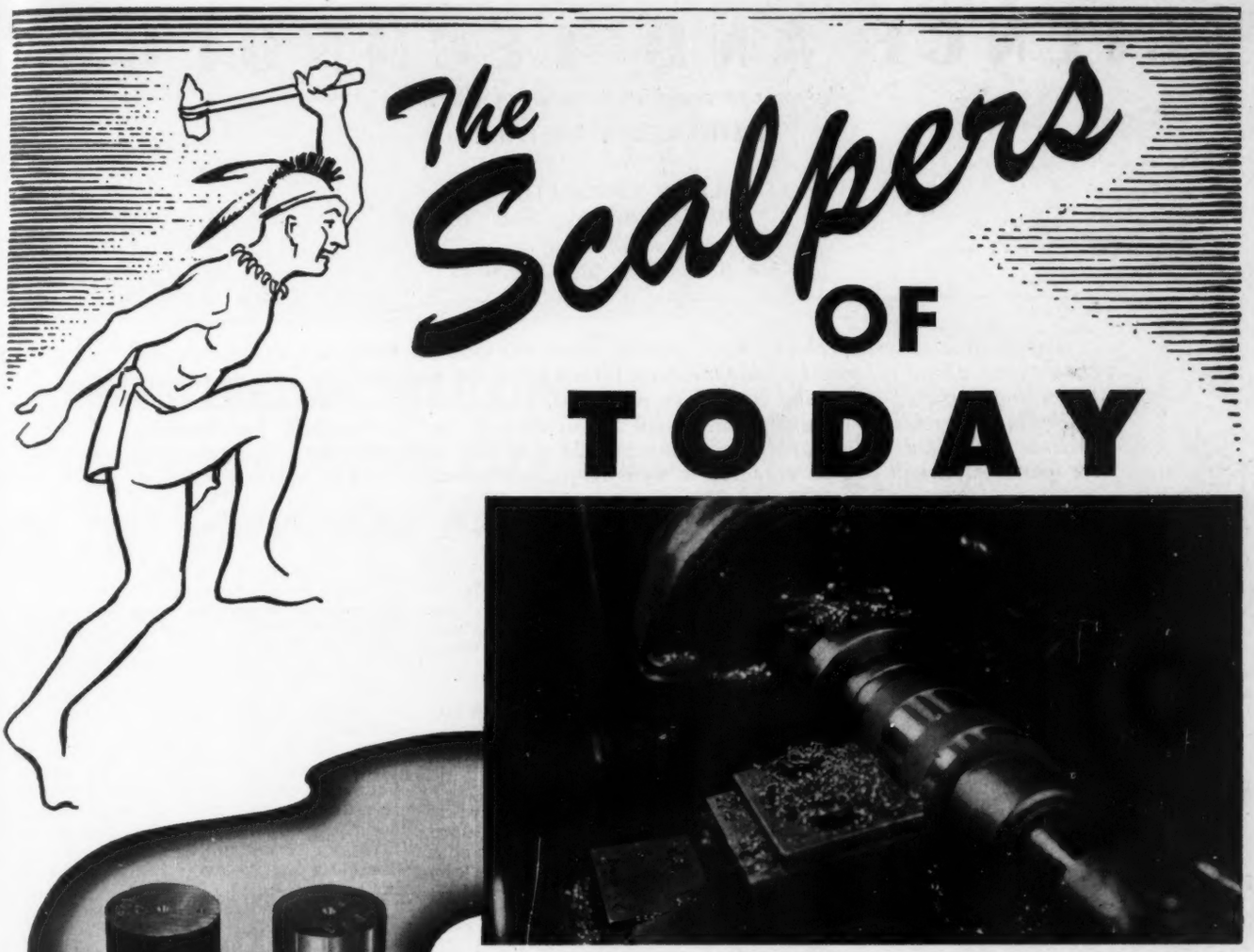
Among other new methods may be mentioned: aniline points of products which develop high pressures at the aniline point; diesel fuel diluent in crankcase oils; Abel flash point of viscous petroleum products; specific gravity by displacement, by flotation and by the Westphal balance; and a rapid method of determining sulphur by combustion in a quartz tube.

A new system for designating tests has been adopted for the new edition. Vapour Pressure (Reid Method), for example, will now be known as I.P. 69/42 instead of G. 37—Burning Test for Kerosine, formerly K. 35(T), is now designated as I.P. 10/42(T). The book includes a table correlating the old and the new serial designations.

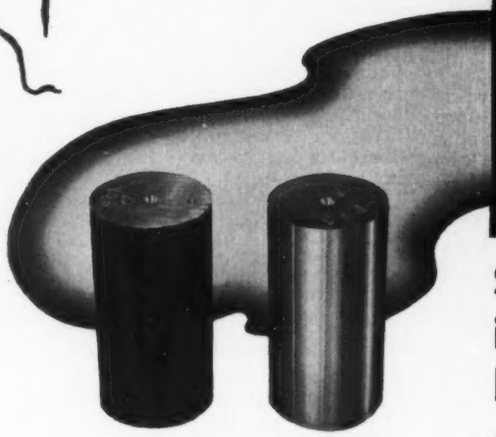
The usefulness of the book has been increased by the inclusion of methods of calculating Diesel Index and Viscosity Index, tables for the conversion of kinematic viscosity to Redwood viscosity, and also of various methods standardized by the American Society for Testing Materials.

These latter tests include Colour by Saybolt Chromometer, Cleveland Flash Point, Gum Stability, Aviation Fuel Knock-Rating, and the Centrifuge Method for Sediment in Fuel Oil.

Certain tests which were published in the Third Edition but which are no longer in general use, have been omitted from the new edition.



The Scalpers OF TODAY



BEFORE AND AFTER SCALPING

SCALPING AT WOLVERINE is a very important procedure. Every brass block—before it is made into a condenser tube—has its skin taken off—so it can be inspected

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Even in the best casting practice, there may be flaws concealed underneath the outside surface. As each billet comes from the furnace, it is cut up into blocks, and each one is put on a lathe to have the outside surface shaved off. This enables us to make a careful inspection to make certain that no imperfections are allowed to go into the extruder and finally into the finished tube.

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Uniform quality is further assured because condenser tubes, like all other Wolverine products, are controlled from ore through to finished product.

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SCIENCE AND TECHNOLOGY

Abstracts prepared in co-operation with the

PETROLEUM REFINER

by

THE LESLIE LABORATORIES

Traver Road, Ann Arbor, Mich.

under the supervision of

DR. E. H. LESLIE and DR. H. B. COATS

The abstracts here presented are selected from the current literature of science and technology to afford reference to fundamental information not easily available to all readers. Abstracts of articles appearing in readily obtainable trade journals are not included.

Photostat copies of original articles will be supplied at cost by the Leslie Laboratories. Complete or limited bibliographies covering special topics by title, by abstracts, or in complete manuscript, will also be prepared and furnished at reasonable cost by the Laboratories.

Fundamental Physical And Chemical Data

Joule-Thomson Coefficients for Two Natural Gases, B. H. SAGE, D. F. BOTKIN AND W. N. LACEY, *Am. Inst. Mining Met. Engrs., Tech. Pub. No.* **1504** (1942) 5 pp.

Joule-Thomson coefficients for 2 natural gases were determined at pressures up to 600 pounds per square inch and at temperatures from 70° to 310° F. From these and known isobaric heat capacities of the components at infinite volume, the heat capacities of the gases were determined. The enthalpies of the gases were computed as a function of state.

Specific Volumes and Phase-Boundary Properties of Separator Gas and Liquid-Hydrocarbon Mixtures, K. EILERTS AND R. V. SMITH, *U. S. Bur. Mines Rept. Investigations* **3642** (1942), 57 pp.

Specific volumes as a function of pressures up to 5000 pounds per square inch absolute and temperatures from 70 to 280° F. were measured for 10 mixtures of separator gas and liquid samples. The phase state of the mixtures was determined. Distillation analyses were made to determine the composition of the natural hydrocarbon mixtures upon a basis of individual components. Compressibility factors for the separator gas were determined for 4 temperatures at pressures of 500-5000 lbs. per square inch absolute. Data obtained with an apparatus for measuring specific volumes of 2-phase fluids at sub-atmospheric pressures were used in computing compressibility factors for the mixtures containing 50 mass percent or more of separator gas. Bubble-point and dew-point phase boundaries of mixtures in the temperature range 60-280° F. were determined from specific-volume data. The locus of the maximum pressures at constant composition and variable temperature at which given mixtures could be maintained in coexisting gas and liquid phases and the locus of maximum pressures at constant temperature but variable composition for maintenance of the 2-constituent system in coexisting gas and liquid phases were evaluated as a function of pressure, temperature, specific volume and composition. The maximum pressure at which a mixture of the separator gas and liquid in any proportion could exist in 2 phases was 3940 pounds/sq. in. abs. At this pressure, the temperature was 149° F., and the composition 62.6 mass percent separator gas.

Nomograph for Pressure Drop in Isothermal Flow of Compressible Fluids, G. W. THOMSON, *Ind. & Eng. Chem.* **34** (1942) p. 1485.

Lobo, Friend, and Skaperdas gave an equation for pressure drop of a compressible fluid in isothermal flow, and a plot giving values of the quantities by means of which the equation could be solved. To avoid the difficulty of interpolation between the curves on their plot, the author presents an alignment chart that gives a direct solution. To illustrate the use of the chart, a specific example is solved.

Phase Equilibria in Hydrocarbon Systems, H. H. REAMER, R. H. OLDS, B. H. SAGE AND W. N. LACEY, *Ind. & Eng. Chem.* **34** (1942) pp. 1526-31.

The specific volumes of five mixtures of methane and decane were established at seven temperatures between 100° and 460° F. for pressures up to 10,000 pounds per square inch. The composition of the gas phase was determined experimentally throughout the heterogeneous region in the same temperature interval. From these primary data the specific volumes, bubble-point pressures, and dew-point pressures for each of the mixtures, as well as the properties of the coexisting phases, were established. The data in the present paper serve to extend an earlier study of the same system with respect to temperature, pressure, and the mole fraction of methane in the mixtures investigated. In principle the methods employed in the volumetric study involved the introduction of known weights of methane and decane into a stainless-steel chamber the effective volume of which was systematically changed by the introduction and withdrawal of mercury. Equilibrium was attained by the use of a magnetically driven agitator located within the equilibrium vessel. The pressure was determined from the indication of a sensitive pressure balance with an uncertainty of not more than 0.05 percent, except at pressures below 500 pounds per square inch where the uncertainty was possibly as large as 0.1 percent. The volume of the system was determined with an uncertainty varying from 0.1 to 0.25 percent. The temperature of measurement was related to the international platinum scale by the use of strain-free platinum resistance thermometers that were frequently compared with a similar device that had been calibrated by the National Bureau of Standards. The authors believe that the temperature was determined within 0.02° F. Weights were ascertained gravimetrically with an uncertainty of not more than 0.02 percent. The data are presented in detail in tabular and graphical form.

Chemical Compositions And Reactions

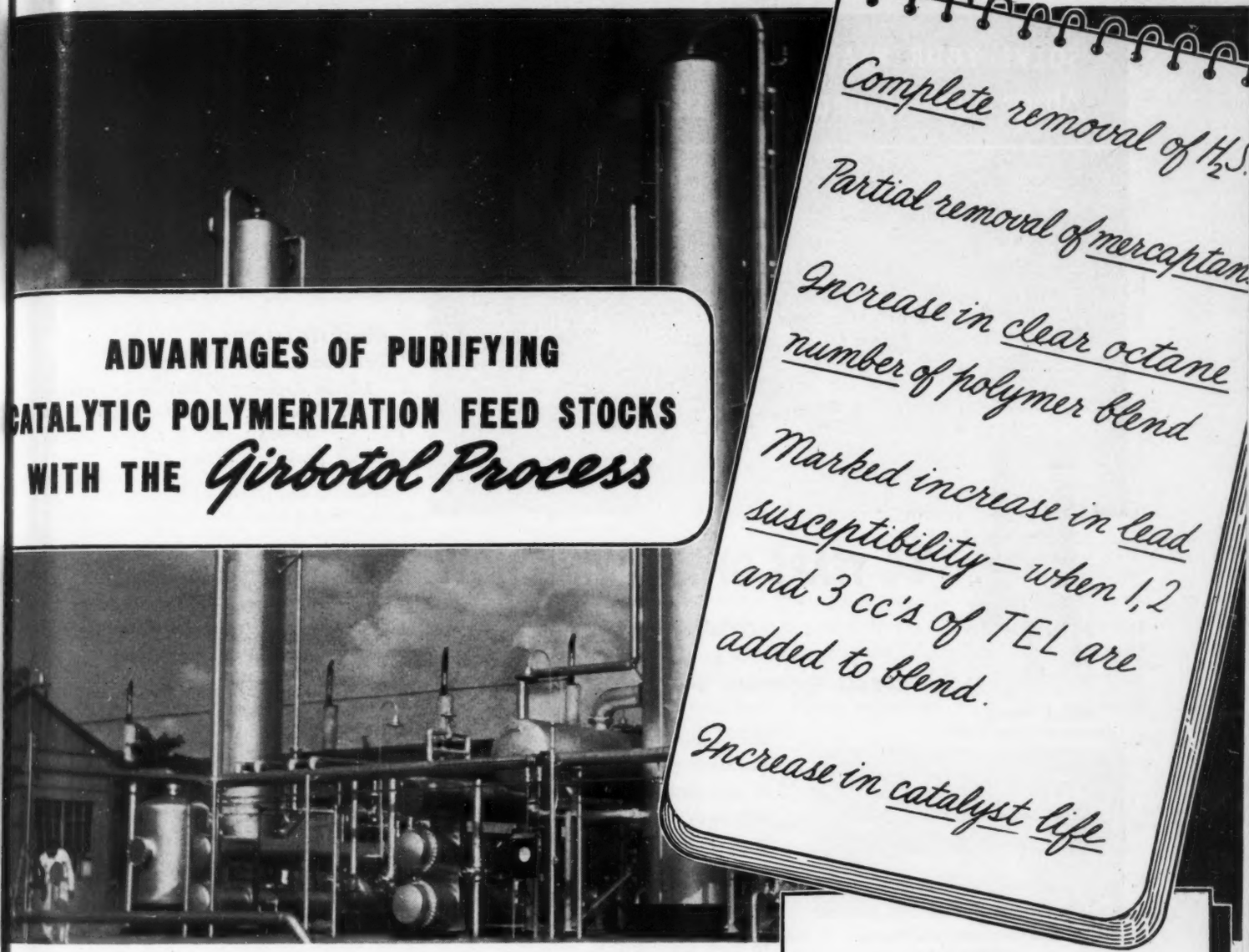
Determination of Inorganic Salts in Crude Oils, E. P. RITTERSHAUSEN AND R. J. DEGRAY, *Ind. & Eng. Chem., Anal. Ed.* **14** (1942) pp. 947-8.

Various methods have been advocated for determining the salt content of crude oils. Recently a cooperative program was initiated among the laboratories of the Socony-Vacuum Oil Company to determine the most accurate and reproducible method consistent with reasonable speed and ease of manipulation. This led to the development of a new method rather than to the recommendation of any previously used method. The newly developed method has been in use in routine work for over a year with satisfactory results. The tetraethyllead extraction apparatus is used in the proposed new method. The authors describe the standardization of the solution and the making of the analysis, and comment on the details of the technique. Typical results are tabulated.

Photomicroscopy of Salt in Petroleum, L. F. CHRISTIANSON AND J. W. HORNE, *U. S. Bur. Mines, Tech. Paper* **638** (1942) 56 pp.

The physical state of the salts contained in crude oil has an influence on desalting. Photomicrographs reveal the details and characteristics of brine emulsions, the effects of demulsifying chemicals on these emulsions, the differences in emulsions themselves, and the chemical resolution of emulsions. Salt contained in brine emulsions will precipi-

GINEERING NOTES ON **GIRBOTOL** GAS PURIFICATION



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Partial removal of mercaptans.

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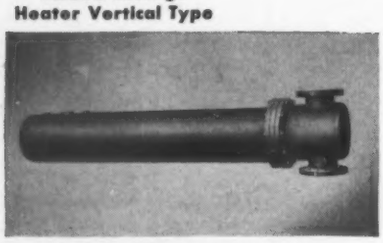

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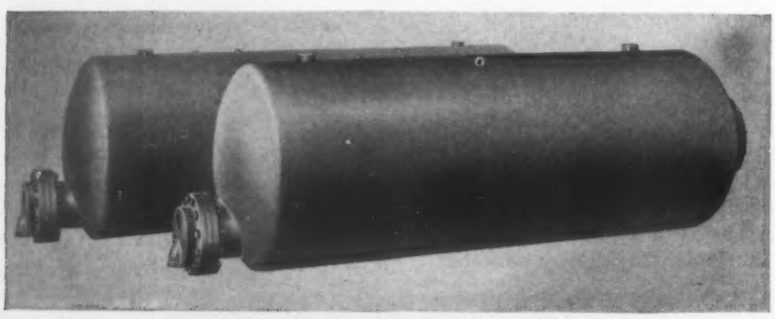

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tate as free or oil-coated microscopic crystals when the emulsion film is broken or when other conditions exist that cause evaporation of water. Therefore, it is better to dehydrate the emulsified oil than to allow opportunity for salt crystals to form from partly demulsified brine. An improper chemical destabilizer will create a very fine or tight emulsoni that may not be detected. Some oils contain native salt crystals. Coated salt crystals that are insoluble in water were also found. In refining, the salts concentrate in the residual oils.

Manufacture: Processes and Plant

Liquid Capacity of Bubble Cap Plates, A. J. Good, M. H. Hutchinson and W. C. Rousseau, *Ind. & Eng. Chem.* **34** (1942) pp. 1445-52.

In large-diameter bubble cap towers, or even moderate-size towers carrying high liquid loads, the hydraulic gradient between the upstream and downstream ends of a plate becomes an important factor in determining the maximum liquid load the plate can handle and still maintain uniform distribution of vapor over the plate. The amount of liquid that can be handled by a bubble cap plate is a function of the driving force and the resistance to flow across the plate. The authors state that some time ago they discovered that the available information on entrainment, pressure drop through caps, and downpipe capacity was not sufficient to permit the design of large towers or of smaller towers having high liquid loads. To obtain information on flow of liquid across plates and the factors affecting distribution of liquid and vapor, work was done with various types of bubble caps and plates in commercial use. The apparatus used and the experimental procedure are described. Besides liquid and vapor rates the variables studied were seal and skirt clearance. The difference of level on a plate can be so great that some upstream rows of caps are rendered inactive, and all vapor is thus required to pass through the fewer caps that remain. Such an effect can lead to high pressure drop of vapor, bad entrainment, danger of flooding, and low efficiency. Hydraulic gradient, or build-up, is shown to increase rapidly with liquid rate, expressed as volume of liquid per unit of time per unit of plate width. It is higher at low skirt clearance and low seal, and increases with increasing vapor rate. For the caps used in this work, the build-up of liquid is proportional to the number of rows perpendicular to the direction of liquid flow, and, therefore, increases with tower diameter. There is a definite relationship between vapor rate and amount of liquid a plate can handle with all caps bubbling. If build-up is no greater than its equivalent in pressure drop up to zero seal, it can be expected that all caps will be active. A criterion is presented that makes possible the prediction of plate stability if the separate values of build-up and pressure drop can be estimated. The authors indicate that they are not proposing a new method for plate design, but rather a method for checking the performance of a plate, the design of which has been determined in the usual manner. Data secured are presented in tabular and

A Report on The Steel Valve Outlook

"What's the 1943 delivery picture for steel valves?"
"How can I get quicker shipment?"
"How long am I going to be able to get repair parts?"
"How will valve material substitutions affect me?"

Culled from the mail, these are the kind of questions which prompt this simple, straightforward report on the wartime activities of The Edward Valve & Mfg. Co., Inc.

Here are the facts.

What About Deliveries?

War needs for steel valves have, of course, increased during the past year. Nevertheless we have tried not to bite off more than we can chew. We have tried to set delivery schedules based on facts, not hopes.

Since critical materials are used in the manufacture of steel valves, limitation orders, directives and revised preference ratings have occasionally resulted in minor delivery changes, but *on the whole, we have been ahead of schedule throughout the past year.*

During 1943 we intend to follow a similar policy. We are serious about keeping or bettering delivery promises.

How About Repair Parts?

When a valve user orders a repair part he usually needs it in a hurry. Therefore we put particular emphasis on delivering parts quickly. *At the close of 1942 there was not a single past due repair part order on our books.*

Orders for maintenance parts are naturally increasing since old equipment must last for the duration in many plants. To help keep these plants running we will continue to give preferred treatment to repair part orders, within the limitations of government regulations, of course.

Simplification Cuts Inventories, Speeds Shipment

The war has brought much voluntary valve standardization and simplification. The user, the distributor and the manufacturer are all gainers.

For years Edward engineers have designed for maximum part interchangeability. As a result, *Edward users today need only small inventories of replacement parts.* The new Edward INTEX valves are a case in point. Only a few simple tools are required for maintenance, and parts are unusually accessible and highly interchangeable. Inexperienced men and women can maintain and operate Edward valves.

Equally important, elimination of "specials" makes possible quantity manufacturing and speeds deliveries. Stick with the standard and you'll get your valves much quicker.

Certain valve types and pressure groupings have been discontinued to free additional war production capacity, but *Edward still builds a complete line of steel valves for all land and marine service temperature and pressure conditions.* Edward sales representatives are experienced valve engineers. Edward valves are also available through leading industrial distributors the country over, with the full assistance of factory engineering and sales staffs at their disposal.

War Materials and War Workmanship

The materials going into Edward valves today are just as good or better than before the war. Actually, very few material substitutions have been required.

Edward workmanship standards, too, are unchanged. Naturally, with a greatly expanded personnel new supervisors have been created, but virtually every new department head or foreman has been promoted from the ranks where he has had imbued in him the Edward principles of closely controlled workmanship. The addition of much new precision equipment makes adherence to Edward standards even more certain.

Post-War Plans

In the Edward laboratories and design departments, an uninterrupted development program is carried on, pointing the way to new refinements, new products, and new post-war applications.

Since our plant is occupied entirely with the manufacture of standard Edward steel valves there need be no time out after the war for reconversion to peace-time valve production. Further, the Company is a closely integrated organization—a single unit complete in one location—making it relatively easy to change to meet changing conditions, yet making possible rigid quality control.

* * *

The only thing certain about the future is that it will be full of change. Undoubtedly many of your problems and ours will be mutual ones. And whether we are able to meet your valve needs or not, we'll be happy indeed to work with you on any matters concerning the procurement, use, maintenance or development of cast and forged steel valves.

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President

The Edward Valve & Mfg. Co., Inc.

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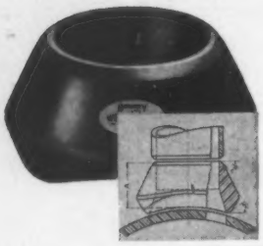

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for welded branch connections.

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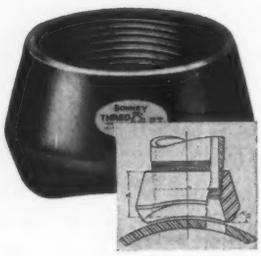

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4. Flow conditions improved—turbulence and friction reduced.
5. Installed in 6 easy steps by welder of average experience.
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7. Provide leakproof junctions of full pipe strength.
8. Suitable for all ordinary pressures and temperatures.
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graphical form, and must necessarily be consulted for the details of the work.

Nomographs for the Absorption Factor Equation, S. CHASE, *Ind. & Eng. Chem.* **34** (1942) pp. 1499-1501.

In certain methods for the design of multicomponent absorbers and column stills the following type of equation appears:

$$E = \frac{A^{N+1} - A}{A^{N+1} - 1}$$

in which E = efficiency of operation, $A = L/K_AV$, absorption factor, N = the number of theoretical plates required. The nomographs for this equation were developed by the use of determinants and transformations as described by Allcock and Jones. The nomograph is presented, and the method of its use is explained. Two nomographs are actually given; in general the higher range chart will be found to serve for the higher values of E.

Manufacture of Butadiene from Ethyl Alcohol I, J. A. GAMMA AND T. INOUYE, *Chem. & Met. Engr.* **49** (1942) pp. 97-100.

The successful production of synthetic rubber from ethyl alcohol depends on the production of cheap 1,3-butadiene, which means cheap ethyl alcohol. Six methods of converting ethyl alcohol to butadiene are reviewed. The direct process for the conversion of ethyl alcohol to butadiene involves the simultaneous dehydration and dehydrogenation of ethyl alcohol as developed in Russia by Lebedev. A typical apparatus is described involving heated catalyst chambers within which the vapors of ethyl alcohol and water, as well as air, are superheated to 450° C. and passed over a catalyst mixture of alumina and zinc oxide at 400-425° C. The pressure is 680-710 mm. of mercury absolute. A yield of 20 to 25 percent of butadiene is obtained, along with 3 to 4 percent of butylene, 5 to 8 percent of ethylene, and a whole series of other hydrocarbons, alcohols, aldehydes, and ether and ketone products. Unconverted alcohol is recycled. Butadiene, along with butene, is scrubbed from the gas leaving the condenser by use of a counter-current scrubber with turpentine as the solvent. Butadiene is removed from the turpentine and fractionally distilled. The final purification step is the separation of butadiene from butylene and ether. The purification described by the authors involves bromination to tetrabromobutane, the brominated product of butadiene, and separation from other brome compounds by fractionation. The brominated product of butadiene is reduced to butadiene by metallic zinc. Other purification methods are briefly considered. Yields as high as 40% can be obtained by properly controlling the temperature of the catalyst mixture. The usual catalyst is a mixture of aluminum oxide for dehydration and zinc oxide for dehydrogenation. However, as dehydrators, uranium oxide or hydrosilicates or basic sulphates of aluminum can be used, and as dehydrogenators, oxides or salts of magnesium or zinc will serve satisfactorily. The preparation of the catalyst is described. A

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And here's an important point . . . you are likely to get better deliveries on "King-clips" than on the scarcer all-bronze valves. The complete facilities of Lunkenheimer distributors are at your service. They'll go out to help you get the things you need.

●

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" information on their orders. This will be of mutual helpfulness.

Fig. 1644
All-Iron

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Boiler Mountings, Lubricating Devices, Aircraft Fittings

bibliography of 13 references is included.

Hazards and Control of Industrial Toxic Solvents, W. M. PIERCE, *Chem. & Met. Eng.* **49** (1942) pp. 85-7.

The probability of chronic poisoning is often ignored by many technical men. In times such as these, when industrial solvents are being used on an unprecedented scale, and often by inexperienced and untrained personnel, it appears wise for every plant engineer to pay particular attention to the possible hazards from these chemicals. In the article the author outlines the symptoms of solvent poisoning as exemplified by benzol, and expresses methods of control. The production of benzene, toluene, and other aromatic hydrocarbons in petroleum refineries in connection with the war program increases the importance of knowledge of the hazards of these materials. Although the maximum immiscible concentration of benzene, expressed as parts per million in air, is 75, as compared to 1000 for gasoline, it is the opinion of authorities that 75 parts per million is too high an allowance. Typical cases of exposure are described, with the resultant effects. Control methods are considered.

Unloading Tank Cars Containing Flammable Liquids, EDITORIAL STAFF SUMMARY, *Chem. & Met. Eng.* **49** (1942) pp. 95-6.

The paper is an editorial staff summary of the bulletin of the Manufacturing Chemists' Association recently published on the unloading of steel tank cars containing flammable liquids. For full details reference should be made to the complete bulletin described as Manual Sheet TC-4, which can be obtained at a price of 12 cents per copy by addressing the Manufacturing Chemists' Association, 608 Woodward Building, Washington, D. C. The handling and spotting and connecting of the car are considered. All electrical equipment should be explosion proof, the area should be provided with fire extinguishers, safety fire blankets, and suitable precautionary signs. Bottom unloading and top unloading are discussed. Proper grounding of the car is emphasized. The handling of empty cars is also considered.

Corrosion of Metals and Alloys by Flue Gases, L. SHNIDMAN AND J. S. YEAW, *Ind. & Eng. Chem.* **34** (1942) pp. 1436-44.

Flue products, resulting from the combustion of most industrial fuels, exhibit a surprising activity with respect to the corrosion of materials with which they come into contact from the time they leave the burner or fuel bed until they are finally discharged into the outer atmosphere. This subject is of importance to the petroleum industry, both as a producer and as a user of fuel. A brief review of studies that have been made of this subject is included in the article. The work reported is the result of tests of various metals and alloys in flue gas atmospheres. Stainless steel (18-8) showed practically no corrosion. Other metals and alloys, such as aluminum, iron, copper, lead, etc., were corroded more or less rapidly from the time of exposure. No chrome-nickel

It Can't Be Done?

Step by step the forbidding sentence "It can't be done", is being erased from chemical thinking

For instance:

Chemistry textbooks for generations had taught that only a few limited fractions of petroleum could produce the 100-octane gasoline needed in unlimited volume by our fighting flyers

That belief didn't even slow up Universal research men They went ahead, discovered principles and developed new processes that multiply production of the precious aviation motor fuel in the very ways believed impossible

And that isn't all They developed processes to make the components of synthetic rubber from petroleum, too—better rubber than trees ever grew

So we will be freed forever from dependence on rubber trees, 10,000 miles from home

It's mighty lucky for our fighting men—for all of us—that Universal research men did not stop at the barrier marked—

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OIL IS AMMUNITION—USE IT WISELY

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Chicago, Illinois

Dubbs Cracking Process
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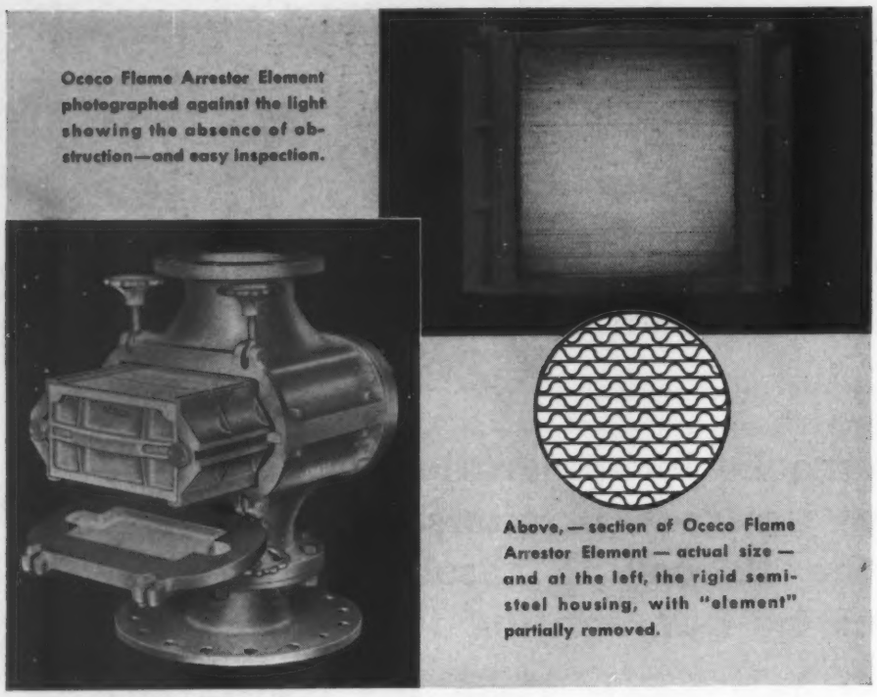
THE REFINERS INSTITUTE OF PETROLEUM TECHNOLOGY



Oceco Flame Arrestor Element photographed against the light showing the absence of obstruction—and easy inspection.

Above,—section of Oceco Flame Arrestor Element — actual size — and at the left, the rigid semi-steel housing, with "element" partially removed.

OCECO ***STRAIGHT THROUGH***
FLAME ARRESTOR PASSAGES

1. ***Positively prevent flame passage***
2. ***Permit free tank venting***
3. ***Minimize entrainment of condensates***
4. ***Assure easy quick inspection***

• As thousands of users know, Oceco Flame Arrestors give real protection. The corrosion-resisting "bank" or "element" assembled from flat and corrugated sheets of aluminum, arranged alternately to form vertical straight through passages is an absolute flame stop,—yet assures free tank breathing with minimum pressure drop. The entire absence of screens and tortuous channels minimizes entrainment of condensation, and clogging, avoiding "cave-ins" and "blow-outs",—and permits easy inspection simply by looking through. Rigid gas-tight semi-steel housings of Oceco Vent Units provide maximum protection against the heat of nearby fires, not afforded when housings of lower melting point material are used.

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steel was attacked appreciably during the first year, and only a few samples were attacked within several additional months. After 18 months all but three of twenty-two samples showed severe attack that resulted in perforation of some test strips within a few months of the first signs of corrosion. A sample containing 17 percent chromium and no nickel was attacked first; increase of chromium content to 27 percent delayed but did not prevent severe corrosion. The 18-8 chrome-nickel steels have a wide range in susceptibility depending upon their source and previous treatment. The low carbon content of 18-8-S samples apparently had no influence on the eventual rate of corrosion. Fractions of titanium and columbium did not impart resistance to 18-8 steels exposed to flue gases for two years. However, molybdenum did. The 25-12 chrome-nickel steel showed low susceptibility; an increase of nickel to 20 percent increased the rate of attack. The expected lives of 20-gage metals and alloys in contact (one side) with flue gas from combustion of manufactured city gas are tabulated. Ordinary commercial steel showed one year; copper and some of its alloys, 7 years; zinc, 8 years; aluminum, 8 years; lead, 15 years; 18-8 stainless steel, 4 to 8 years; 18-8-Mo showed corrosion so slight that no calculation of time could be made. The article describes the test method used, and tabulates the data secured in some detail.

Products: Properties And Utilization

Natural-Gas Research at the Mineral Industries Experimental Station, A. W. GAUGER, *Penn. State Coll., Min. Inds. Expt. Sta. Bull.* **33** (1941) pp. 76-94

The paper is an historical review of the subject. However, a new method for determining moisture in natural gas is described. An accurately measured quantity of gas is passed through a freezing tube. The condensate is mixed with 25 cc. of indicator solution ($CoBr_2$) and placed in a colorimeter. The percentage transmission for 3 colored filters is measured, pseudochromatic coefficients are calculated, and moisture content is read from a chart.

Viscosity Characteristics of Lubricating Oils Saturated With Natural Gases at High Pressures, J. S. SWEARINGEN AND E. D. REDDING, *Ind. & Eng. Chem.* **34** (1942) pp. 1496-8.

The authors report a study of the effects of blending to improve the characteristics of lubricating oils for natural gas compressors at pressures up to 3500 pounds per square inch. This has become of greater importance because of the use of high pressure compression of natural gas in the gas cycling process for the production of condensate, and in numerous process applications. In these cases the natural gas is in contact with the lubricant at high pressure, and accordingly the result is a solution of gas in the injected lubricant. The authors constructed a capillary tube type viscometer mounted inside a bomb. The apparatus permitted determination of density as well as viscosity. The apparatus and procedure are described in some detail. The results are presented in graphical form. The properties of

Dowtherm's success measured

in B.T.U.'s

Dowtherm has made an extremely impressive record of service in the petroleum and other branches of American industry. This system of heat transmission was developed for high temperature processing, especially where controlled temperatures from 400° to 650° are required.

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CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

castor oil were found to be uniquely different from those of oils of petroleum origin. A table is given that compares the viscosity of the oil when saturated with natural gas at atmospheric pressure, and at 3000 pounds per square inch gage. The smaller this ratio the more suitable the lubricant. The data consistently indicates that the addition of a light oil to a heavy oil produces an oil of intermediate viscosity which is characterized by a lesser drop in viscosity with subjection to natural gas pressure.

The Role of Surface Chemistry and Profile in Boundary Lubrication, J. T. BURWELL, *S. A. E. Jour.* **50** (1942) pp. 450-7.

The theory of boundary lubrication is considered, with special attention paid to the effects of roughness of the metal surface. The coefficient of friction between lubricated surfaces increases with the roughness up to 20 micro-inches, after which it remains essentially constant. It is little affected by the addition of oleic acid or sulfonated oil if the surface is very smooth, i.e., 2 micro-inches. The effect of the addition agent becomes more marked the greater the roughness. The author concludes that the contact angle of any oil with any metal is probably always zero. However, the contact angle of oleic acid with metal is apparently not zero. The acid molecules form an adherent unimolecular layer on the metal that tends to repel the bulk of the acid. Data are given on the relative energies of adhesion to stainless steel of mineral oil with and without 1 or 2% of various polar additives. The energies are almost the same for all the doped oils regardless of the addition agent.

Determination of the Lead Susceptibility of Motor Fuels, E. SINGER, *Oel u. Kohle* **37** (1941) pp. 804-6.

The author develops a coefficient for lead susceptibility by multiplying the octane number of the reference fuel by the increase in octane number caused by the addition of 0.1% by volume of tetraethyllead and dividing by a factor of correction that depends on the amount of tetraethyllead added and indicates the readjustment of the increase in octane number for the additions of tetraethyllead in amounts different from the usual 0.1% by volume to the normal addition of 0.1% by volume. A special system of coordinates (Oppau-Linien-netz) has been developed in the Oppau testing laboratory for recording the increase in octane number as a function of the tetraethyllead addition. By the use of this method the lead-susceptibility curves of gasoline become straight lines.

Durability of Road Asphalts, V. A. ENDERSBY, F. H. STROSS AND T. K. MILES, *Proc. Assoc. Asphalt Paving Tech.* **13** (1942) pp. 282-316: discussion 316-28.

Consideration of the literature on bituminous roads indicates that observations by road engineers from 1913 to 1937 has led to the use of softer asphalts and controlled aggregates. After a consideration of the difficulties encountered in the design of proper mixtures, the authors describe a series of 17 test areas in which different compositions were used. The raveling resistance was relied upon as an index of durability. The ratings obtained by the accelerated trial tests show close correlation with field observations. Based on the test results, durability test methods have been developed that can be used to test the asphalt prior to construction. This "oxidation rating and deterioration index" is described.

Softening of Oxidized Asphalts by Heating at High Temperatures, and Its Relationship to Oxidizing Temperatures and Recovery Temperatures, G. ABSON, *Proc. Assoc. Asphalt Paving Tech.* **13** (1942) pp. 182-9; discussion 189-93.

The author determined the effect of heating asphalts on their penetration and ductility at 25° C. and on their softening point. The asphalts were heated, both by themselves in Church flasks with the distillation tube open to the atmosphere to prevent loss of volatile material, and in solution in standard CO_2 recovery. From the data obtained it was concluded that oxidized asphalts become softer when heated to temperatures above those used in oxidizing them, but below cracking temperatures. Steam- or vacuum-refined asphalts, when subjected to similar treatment, are not softened to any noticeable extent. The softening effect of heating oxidized asphalts under given conditions is exactly the same whether heated with or without a solvent. In recovery tests, reheating a sample recovered at 325° F. produces the same degree of softening as occurs in heating oxidized asphalts to a given temperature. Recovery of asphalts from paving mixtures at 300-325° F. will in-

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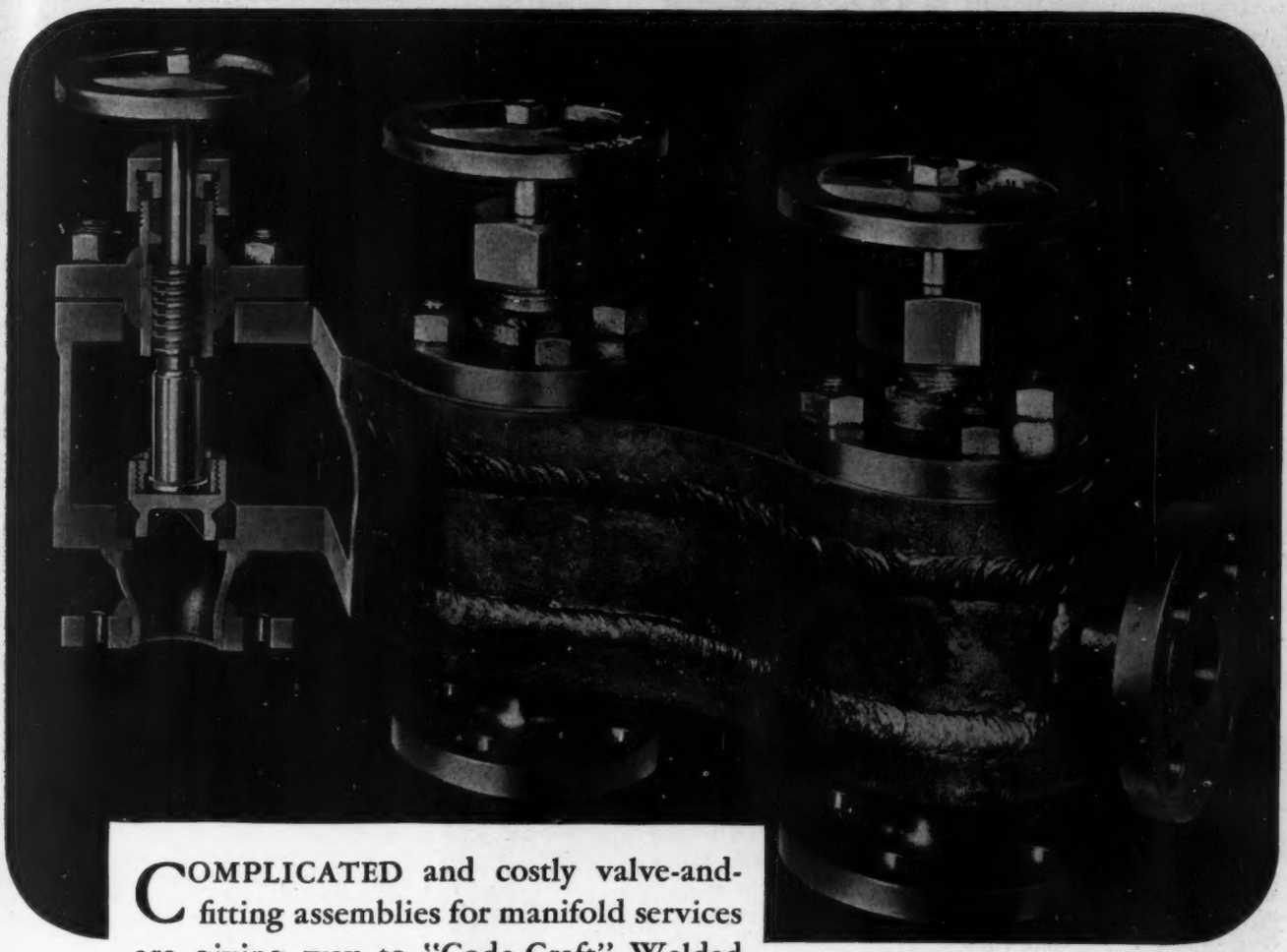

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sure less change from the softening effect of heating than any higher recovery temperature.

The Examination of Ethyl Alcohol and Alcohol Blends for Use as Motor Fuel, S. J. W. PLEETH, *Jour. Inst. Petr.* **28** (1942) pp. 240-56.

The post-war world will see an increase in the use of home-produced substitute fuels such as alcohol and benzole, in all countries not possessing natural petroleum resources. For this reason it is considered expedient at this intermediate stage to discuss tentative methods for the testing of such materials and their blends with gasoline, insofar as these tests differ from the standard methods of the Institute of Petroleum, or the American Society for Testing of Materials. The author's paper deals with the examination of ethyl alcohol and its blends with benzole and gasoline as practiced in the Central Laboratory of the Cleveland Petroleum Company, an organization with many years of experience in marketing a successful and popular alcohol blend. Proposed specifications for ethyl alcohol are given. Tests for the specific gravity, distillation range and water content are described. The examination of motor fuels containing alcohol differs but little from that of other motor fuels. The author considers tests for specific gravity, distillation, vapor pressure, and water tolerance. The triangular equilibrium diagram for benzene, gasoline, and ethanol is given, together with methods for examining the phases.

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ARMSTRONG'S INSULATING REFRACTORIES

Automatic Leveling Bulb Lifter for Butadiene Analysis, W. R. ATWATER, *Ind. & Eng. Chem., Anal. Ed.* **14** (1942) p. 954.

In the gasometric determination of butadiene in gas mixtures the sample is passed back and forth through a U-tube containing maleic anhydride. The routine analysis of a large number of samples is tedious and time-consuming unless an automatic device for raising and lowering the leveling bulb is used. An automatic device for this purpose is described in some detail. Samples containing up to 30 percent butadiene require only filling the buret with a gas sample, recording the initial volume, starting the device, and recording final volume after 20 minutes. One device may run two or more burets.

Practical Consideration of Various Road Asphalt Emulsion Characteristics and Factors Affecting Them, A. J. DAY, *Proc. Assoc. Asphalt Paving Tech.* **13** (1942) pp. 256-77; discussion 277-81.

The author discusses in detail the importance of proper methods for the determination of each property of asphalt emulsions, such as viscosity, physical and chemical stability, miscibility, surface tension and lability, penetration, ductility, solubility, ash and specific gravity of the recovered asphalt.

Controlled Reduction of Road Oil to 100 - Penetration Consistency, T. W. THOMAS AND K. A. MAEHL, *Eng. News-Record* **129** (1942) pp. 432-3.

A study of road oils used in Minnesota during 1941 showed that the time of reduction to 100 penetration gave a good indication of the rate of setting in practice. A.S.T.M. Method D243-28T, with some modifications, was used, and it was found that reproducible results could be obtained provided the temperature was rigidly controlled. A gauge is described that was devised to facilitate control of heating by measuring the difference in pressure across a capillary tube through which the gas flows to the burner.

Reduction of Ash Content of Residual Oils with Boric Acid, E. T. SCAFE, K. F. HAYDEN, AND V. A. KALICHEVSKY, *Ind. & Eng. Chem., Anal. Ed.* **14** (1942), pp. 923-6.

Petroleum oils containing appreciable quantities of naphthenic acids are frequently distilled in the presence of sodium hydroxide in order to improve the quality of distillate fractions and minimize corrosion of equipment. The sodium salts resulting from this treatment are concentrated in the still residue, which is commonly referred to as "soda tar." Soda tar is not satisfactory for use as fuel because on burning it deposits an alkaline residue that has a deletorious effect on furnace refractories. Hence, the reduction of the ash content of soda tar is of considerable economic importance. Removal of the salts by washing with hot water is not usually feasible because of emulsion formation. The authors have developed a practical method for de-ashing residual oils containing sodium naphthenate salts. The oils are treated with boric acid at about 400° F. and the acid is recovered

from the resulting sludge by acidification with sulfuric acid or sulfuric acid sludge. The treated oils are free of moisture and easily pass general specifications developed for industrial fuels. The results of the work show that the treating and settling temperatures should be maintained at about 400° F. At this temperature the boric acid is melted, which permits its thorough mixing with the oil. Higher temperature offers no advantage but necessitates the use of higher pressure owing to the presence of small quantities of water in the system. Temperatures lower than 400° F. increase the settling time, particularly with high-viscosity oils. The article presents data secured in the course of the work, and illustrates the type of apparatus used for the batch and continuous treatment experiments conducted in the laboratory.

A Note on the Use of Active Magnesia for the Regeneration of Used Lubricating Oils, G. A. SMITH, *J. Chem. Met. Mining Soc. S. Africa* **42** (1942), pp. 321-5.

The use of magnesium oxide was tested for regenerating oil using approximately 1 pound per gallon. The fractions finer than 240 mesh gave the fastest filtration rate. Prolonged grinding of the oxide had a detrimental effect. Care must be taken to reduce the percent of particles over 200 mesh to a minimum, and also to avoid overgrinding. Of the filter aids tested, only kieselguhr and sawdust were useful; the latter was the most effective. Sawdust maintains a certain porosity during the later stages when the flow tends to cease as the filter becomes clogged. There is little value in increasing the weight of sawdust above 100 grams per pound of MgO. The sawdust did not affect the quality of the oil. The carbon residue and oxidation properties were not affected, but there was a small increase in the saponification value. All oils tested filtered satisfactorily except the heaviest, that required an increased weight of sawdust. Magnesium oxide and bentonite can be used in admixture. Traces of water in the filter were found to have a deleterious effect on filtration rate. Fresh magnesium oxide should be used, since it tends to degenerate through hydration. Magnesium carbonate should not be calcined at temperatures higher than 850° C. CO_2 content should be less than 4-5 percent.

Plummer Transferred by Imperial Oil Company

Stephen B. Plummer has been transferred by Imperial Oil Company from its plant at Ioco, British Columbia, where he has been chief chemist, to Sarnia, Ontario. He will assume an important technical position there in connection with synthetic-rubber production. Plummer joined Imperial Oil Company in 1926, and has been very active in public affairs at Vancouver, particularly in connection with youth movements. He was in command of the No. 59 Vancouver Rotary Squadron of the air cadet movement at Vancouver, and is past president of the Royal Air Force Ex-Officers Association. He went overseas in the last war with the Princess Patricia Light Infantry and transferred to the Royal Air Force.

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Welding Control

THE LINCOLN ELECTRIC COMPANY

A uniue type of arc welding control, which enables the welder to speed up his work and do a more accurate job, has been announced by The Lincoln Electric Company of Cleveland.

This control, called the "Lincolntrol," which is almost as light as a shoe, is strapped onto the welder's foot and enables him to move about with it freely. It is specially intended for aircraft welding, but is applicable for welding of light-gauge sheet metal of all kinds. Because it is so easily used, it will be a boon to women welders, who are taking up this type of work in aircraft plants in increasing numbers.

With the control strapped to his foot, the welding operator merely presses down on the pedal which moves the pin to operate a current control. As he exerts pressure he increases the current.

This permits very accurate control over the welding arc, and achieves in one unit the same results as both the so-called "hot-start" and "crater eliminator." Because he has complete control, he can adjust the arc at any time without changing his position. Yet while welding in and around a fuselage assembly on "pick-up" work, he can move around at will without the hindrance of constantly keeping his foot in one place as is necessary with conventional foot controls.

Thus, the control eliminates the necessity of making adjustments on the welding machine, due to such things as minor changes in thickness, and changes in fit-up and enables the operator to weld in any position which he finds convenient or comfortable. The complete control of the arc gives an improvement in the quality of the weld, reducing the danger of a weld burning through or getting poor fusion or penetration.

Lincoln Electric Company's are welding "Lincolntrol" is unique in the ease with which it is operated and in its effectiveness. It is strapped on the foot and is almost as light as a shoe.

Plastic Spray Gun

ECLIPSE AIR BRUSH COMPANY

Eclipse Air Brush Company, 500 Park Avenue, Newark, New Jersey, has perfected a plastic body for its spray gun. This plastic gun weighs a quarter of a pound less than the model with aluminum body, which has been replaced. In part the announcement was:

"The plastic has good chemical resistance and is not affected by thinners. solvents. paint removers, etc.; it is strong, having good impact strength.

"The smooth black surface is easy to clean and makes a good appearance with its metal fittings.

"These guns have been on the job for several months in places where equipment of this type is in constant use under strenuous conditions: shipyards, aircraft factories, munition plants, etc.

Rotary Hand Pump

BLACKMER PUMP COMPANY

Blackmer Pump Company, Grand Rapids, Michigan, is making a new rotary hand pump.

Its basic design follows the sliding-vane principle, characteristics of other Blackmer pumps. The base is fitted with an offset flange, which permits mounting on the edge of any flat surface, such as the top of a tank, vat or other container, while providing ample clearance for free operation of the crank.

The new pump was developed primarily for use as a bilge pump on lifeboats and meets government specifications for this purpose. However, tests indicate that there are a number of other applications, both marine and industrial, in which this new unit represents an improvement over present pumps. It will therefore become a standard unit in the Blackmer line of rotary hand pumps.

Blackmer Hand Pump

The casing, rotor and buckets of the new pump are made of bronze for lifeboat service. For other services they may be made of iron with bronze fittings, or all iron. The casing bolts, on the lifeboat pumps are fitted with special wing-nuts for easy removal. For other services standard hex-nuts are used.

Industrial Lamp

RADIANT LAMP CORPORATION

Radiant Lamp Corporation, 260 Sherman Avenue, Newark, New Jersey, has introduced a new type spatter-proof lamp for welding and other industrial uses. The lamp is made of a special glass, which resists penetration or hot metal particles and is built to withstand severe handling.

Rust Proof Paint

RUST-OLEUM PAINT CORPORATION

Rust-Oleum Paint Corporation, Evanston, Illinois, has introduced two new paints, silver gray and fume-proof silver gray.

The first is manufactured strictly for outdoor and some indoor uses on metal, concrete, brick and wood. It gives a high gloss finish and dries in from six to eight hours. This plaint is excellent for use in maintenance and new construction work in light industrial, residential and agricultural districts where

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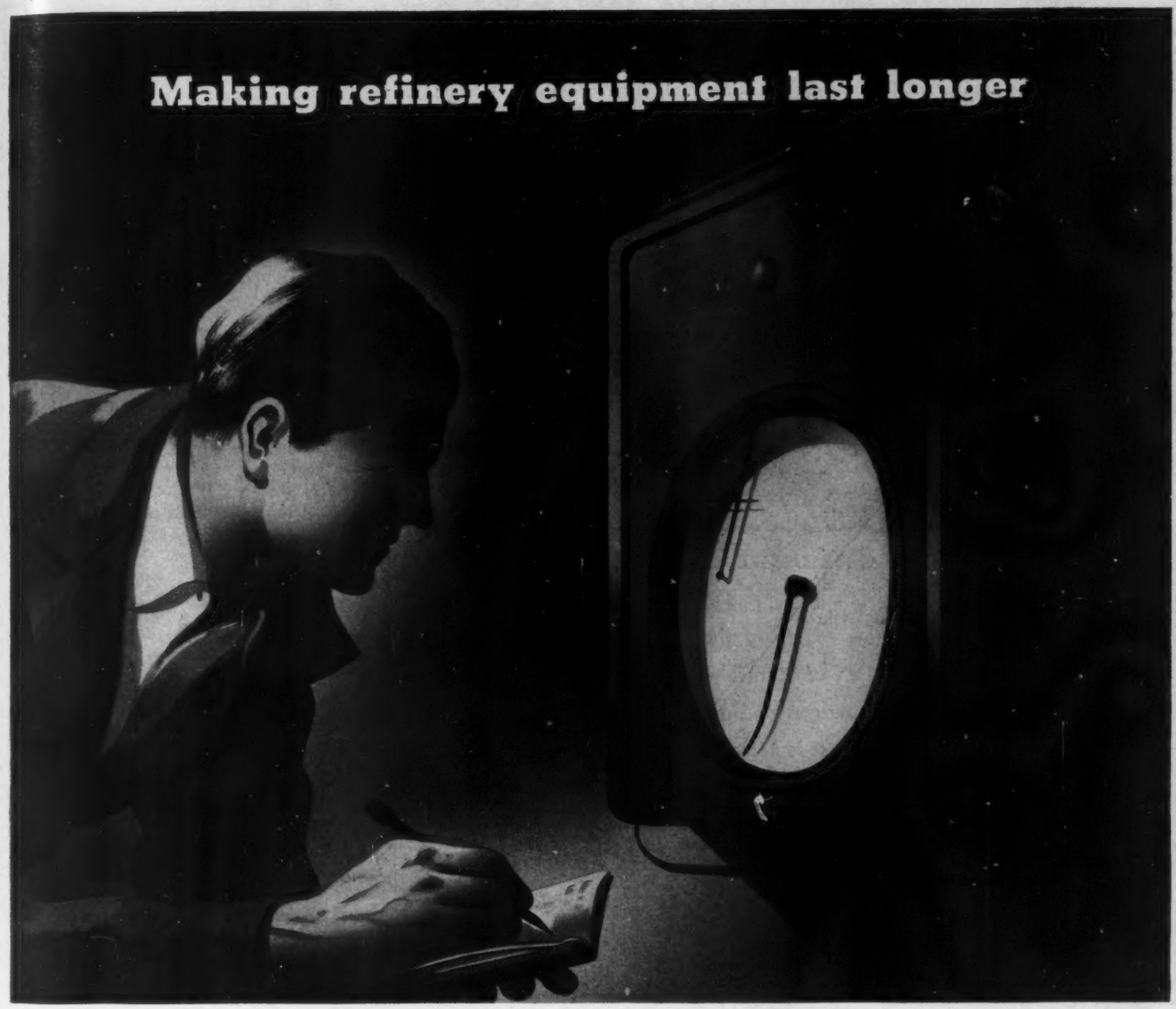

Information supplied by "Petroleum Refiner"

Premature aging of refinery equipment is a dangerous ailment. Always, it is costly. Today, it might mean a shut down plant. Keep your "iron men" in service by care.

In machinery, lubrication in the right places with correct oils protects surfaces. Shafting properly aligned with bearings is in line with good performance and long life. Frequent cleaning removes erosive dust and keeps the tell-tale whiskers off machinery. Avoidance of needless overloads eliminates the strains and injurious high temperatures that age a machine.

Tanks, drums, towers and piping — watch them too. Watch for and combat corrosive agents in oils, such as sulphides and chlorides. A California refiner who had been losing 10 bubble cap trays every two years by corrosion began chemical treatment of his charge stock and cut losses by 73 percent. Overfired furnace tubes are headed for scrap. Overheating can be prevented by even heat distribution in the furnace, avoidance of flame impingement and periodical coke removal. Keep close watch on instruments for symptoms of overheating. Purity of cooling water is important. If it carries acids, alkalis or sand, these may shorten the life of condenser tubes, cooling coils, pipe and valves.

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only minor fume conditions exist on sash, buildings, tanks, fences, bridges, structural steel, guard rails, etc. Where positive protection against rust plus the appearance of aluminum is desired, this paint will give unusual satisfaction.

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On structural steel tanks, fences, machinery, hydrants, signs, guard rails, bridges, steampipes (as in breweries, dairies, etc.), this paint provides highly satisfactory protection, plus the desired aluminum-like appearance. It withstands 450° F. and all weather conditions.

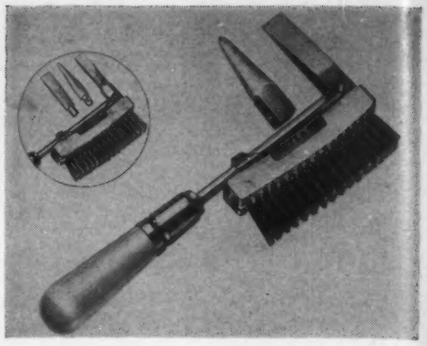
In order to assure the correct applications of these coatings the company provides a consulting service for the analysis of special rust prevention problems.

Cleaning Tool

ATLAS WELDING ACCESSORIES COMPANY

Atlas Welding Accessories Company, 307 Boulevard Building, Detroit, Michigan, has announced a new and improved weld cleaning tool for welders in shipyards, aircraft and tank plants, boiler and sheet metal shops, and for oil pipe line, factory maintenance and general welding work is now being manufactured under the name Dual-Tool.

The Dual-Tool combines a wire bristle brush and a slap-removing bit in one unit and features a specially-developed brush holder which permits removal of brush for reversing or replacement by inserting screw driver or other sharp object at rear end of holder. An up and outward pry releases tension. Brush pops out. Reverse action for inserting and brush snaps in to a firm, rigid seat.



Atlas Cleaning Tool

Every part of the tool is replaceable, and Atlas manufactures a complete line of replacement parts, including interchangeable cone and chisel bits.

Metal Spraying

METALLIZING ENGINEERING COMPANY

Metallizing Engineering Company, Long Island City, New York, announces the new Fuse-Bond Process, and equipment for its application, whereby machine components and similar metal parts now may be prepared for metallizing electrically. Main advantage of the process is that it affords an adequate bond on the hardest surfaces, heretofore impossible or impractical to prepare by blasting or rough threading. It also simplifies preparation of narrow edges, flat areas, and cylindrical parts having keyways, and other interruptions in their surfaces.

Application of the process is with the Metco Fuse-Bond Unit. Operating on any 110- or 220-volt, single-phase power line, this equipment fuses a rough deposit of electrode metal into the surface to be metallized. Electrodes are applied to the work with a special holder which uses up to six electrodes at a time, depending on the size and nature of the part to be prepared. Small parts may be prepared with this equipment as easily as large shafts, since there is no excessive heating of the base metal, or disturbing of its physical characteristics.

The Fuse-Bond Unit is extremely compact, and is contained in a cabinet measuring only 24 inches high. Weight complete is but 170 pounds. All cables and attachments fit into a bin in the top of the cabinet. Mounted on casters, it can be wheeled right to the job with ease. A complete instruction manual provides all operating data. Unskilled labor can operate efficiently within an hour or so.

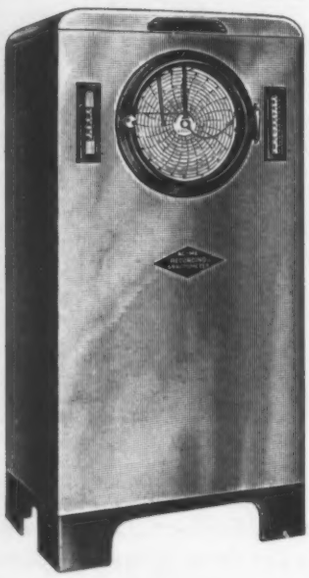
Clearing House for Material Substitutes

J. J. Berliner & Staff, 225 Fifth Avenue, New York, has instituted a service through which industrial concerns can get information for substitutes and alternates of materials to help solve the problems that arise because of scarcities and priorities. Scope of this service has been described in the announcement as follows:

"A staff of technical research experts has completed the task of compiling and cataloguing substitutes or alternates obtainable today for practically every item classified as scarce or likely to be short soon. Information was studiously gathered and digested from every conceivable source including private and

SERVICE ACCURACY THE R.S.Co TULSA

—*Automatic Compensation*—
AC-ME GRAVITOMETER



Accurately records the changing gravity of gas and automatically corrects for variation in temperature and barometric pressure.

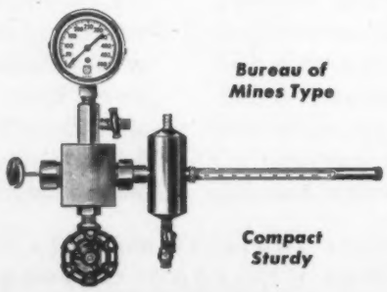
Elimination of complicated rotating parts from the design permits simple, sturdy construction that requires only a minimum of maintenance to keep the instrument functioning.

Charts are changed without exposing the main part of the instrument. A large glass door gives complete visibility to the record while the instrument is operating.

DEW-POINT TESTER — ***tests under actual conditions***

Accuracy within 0.2° F. even on high pressure gas transmission lines. Dew Points can be determined with safety at high pressures under actual working conditions.

This unit is sold complete with hardwood carrying case, adjustable field tripod, 25 feet of ¼-inch copper tubing and necessary fittings.



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YOUR CORROSION PROBLEM CHANGED WITH PEARL HARBOR

...because the Pearl Harbor attack launched America on its drive to victory... and that drive to ultimate victory changed "business as usual."

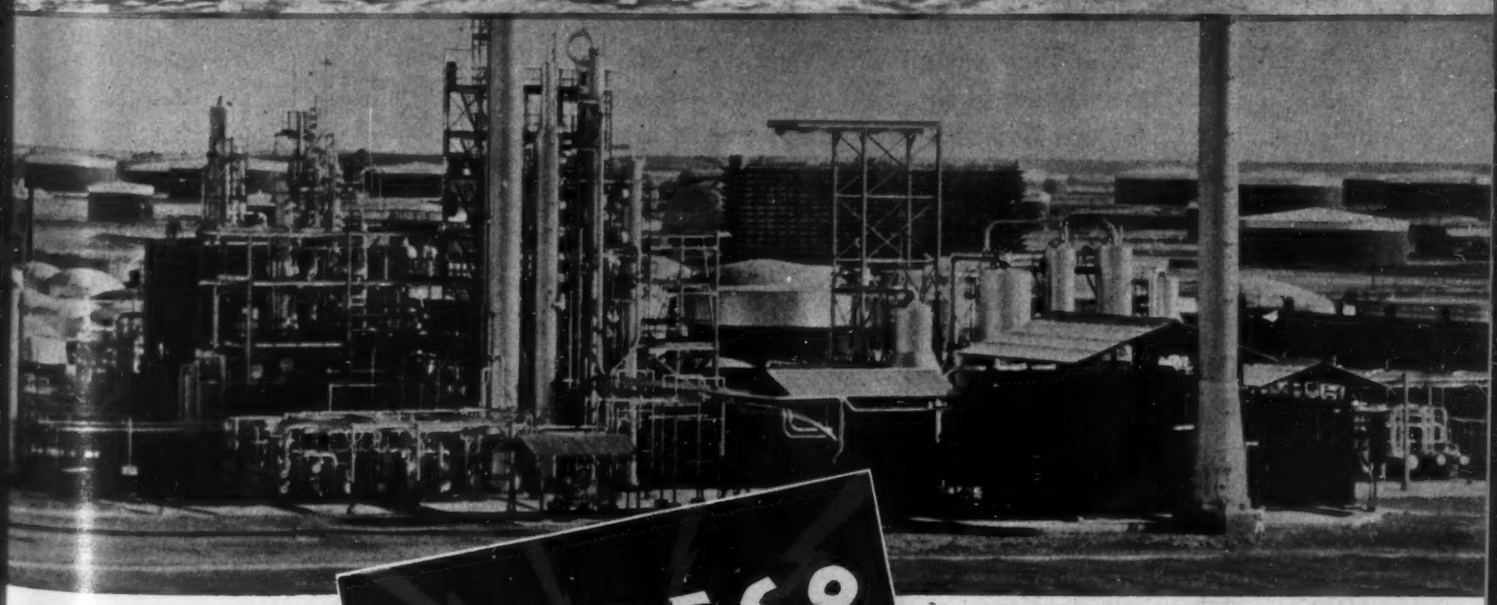
In refineries, in spite of the vital war job they are doing, the scarcity of corrosion-resistant alloy metals is bound to affect heat exchanger maintenance.

Salty crudes are a recognized cause of corrosion and plugging in heat exchangers. Salt hazards not only shorten exchanger tube life and increase necessary replacements; they also lead to inferior products and retarded throughput rates.

Formerly, one answer to salt trouble in exchangers was frequent maintenance work. Now, such procedure is, as always, costly, with the scarcity of quality alloy metals increasing the impracticability of a maintenance plan based on frequent replacements.

The certain way to conserve heat exchange equipment is to *keep salt out.* Petreco Electric Desalting is doing this to the complete satisfaction of many leading refiners. Consult a Petreco representative regarding corrosion prevention in your refinery.

Official U. S. Navy Photo • Pearl Harbor Scene



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Representatives in all principal fields and refining centers.

DESALTING **DEHYDRATING**

governmental experimental stations from all accessible countries throughout the world. Technical laboratories, schools, catalogues, press clippings, trade exhibits, engineering societies, new books, and patent records were investigated and desired information recorded. Many months of painstaking effort have gone into the work and every assurance is offered that the information is authentic and thoroughly reliable."

Hydrofluoric Acid

Harshaw Chemical Company, 1945 East Ninety-seventh Street, Cleveland, has issued a bulletin "Anhydrous Hydrofluoric Acid," which represents a compilation of the published information on this chemical, which is coming into use as a catalyst in refining processes.

In addition to the properties of the chemical, the bulletin gives detailed information on methods of handling the product in aqueous and anhydrous forms.

Electric Arc-Welding Developments

By R. F. WYER
Welding Engineer, General Electric Company

IN 1942, as in 1941, there were more notable developments in the field of arc welding operations than in new equipment or processes. Welding operators and supervisors deserve the praise of the industry for their almost incredibly effective performance in the battle of production.

The enormous expansion in the use of arc welding was aided in a large measure by the conservation activity of operating men which resulted in savings of electrode, time, electric power, and equipment. These savings contributed to greater production of war tools just as surely as did expanded production facilities.

For example, many plants instituted intensive campaigns to reduce waste in electrode stubs, some adopting the plan of checking returned stubs for number and length before issuing new electrodes from the stock room. By this means, production per pound of electrode consumed was increased as much as 20 percent.

Stress was placed on the importance of good fit-up of joints in conserving deposited metal, and of proper adjustment of welding current and arc voltage to reduce spatter loss. The skill and cooperation of welding operators in avoiding oversized fillets and excessive reinforcement helped still further in saving electrodes.

Savings in time were accomplished by the use of larger electrodes where practical; in many cases such use of larger electrodes resulted in an increase in production per hour of as much as 33 percent. This trend also helped to alleviate the electrode shortage by making possible the production of greater tonnages of electrodes with existing production facilities. Higher duty factors through the reduction of electrode-changing time further contributed to increased production.

Power was conserved through the more efficient use of welding machines and through the greatly increased use of alternating-current welders with a consequent reduction not only in the energy consumed but in the copper wire and other facilities required to deliver the energy. The latter reduction was augmented by improved arc-welding load-power factor through the use of capacitors built-in or attached to arc-welding equipment. A further part in conservation was played by increased stress on the maintenance of arc-welding equipment and accessories.

Among the outstanding developments in 1942 were the employment of women as arc-welding operators and the use of improved methods for the mass training of large numbers of new operators. The latter effort was marked not only by the establishment of fully equipped welding schools by individual fabricators, but also by the widespread use of motion pictures to shorten the time required for training.

The past year witnessed a broad expansion of the use of previously developed equipment and processes. This was in line with the recognized necessity for standardization and avoidance of special requirements in achieving maximum productive efficiency. The application of atomic-hydrogen arc welding was largely extended in the aircraft field where such parts as propellers, landing gear parts, superchargers, and oxygen cylinders were produced in large volume with the aid of atomic-hydrogen arc welding. A new multiple-arc automatic atomic-hydrogen arc-welding head went into production in

After the war, motorists will have fuels far better than any gasoline they ever used. In the making of these products, now reserved for war and still developing,

HOOKER Chemicals

are aiding materially—in the production of the new high-octane gasolines, synthetic rubber and other petroleum-derived substances. In all applications, the purity and uniformity of HOOKER chemicals aid in maintaining war-speeded schedules.

HOOKER technical specialists are always available for consultation on chemical problems relating to the manufacture of petroleum products.

3441-A

WE CAN DELIVER THIS COOLING TOWER *QUICK!*

Okay—let's go!

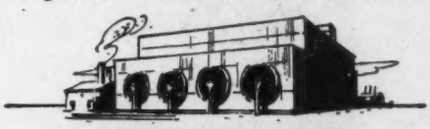
Key to the critical manpower situation is simplification of field tower erection which requires only unskilled labor. Tower erection is always under supervision of permanently employed Fluor Field Superintendents, who bring to your job many years of experience and all the necessary know-how. *Thus prefabrication solves another vital problem!*

THIS is a Fluor Atmospheric Aerator Cooling Tower. It requires no critical, hard-to-get equipment such as fans, gears and motors. It requires the fewest man-hours to build and completely eliminates the man-hours consumed in the production of unneeded auxiliary equipment. It requires the absolute minimum of critical materials. These are reasons why Fluor can deliver this kind of Cooling Tower—*quick!*

But another, equally important reason speeding delivery of Fluor Atmospheric Aerator Cooling Towers is 100% prefabrication in our plant—an *exclusive* Fluor feature. Important in peacetime, prefabrication is an even more desirable advantage in wartime. Because of it, Fluor has never once failed to deliver either ahead of schedule or on time during the Defense or War Program!

It means no delivery of raw lumber and no manufacturing operations on your premises with the attendant confusion and interference with your construction program or the normal conduct of your operations. Under Fluor prefabrication, the only work done on your property is actual erection accomplished in minimum time by a small crew.

Fluor Atmospheric Aerator Cooling Towers have established an enviable record for highest thermal efficiency in the service of some of America's foremost industrial organizations. They are the answer to the water cooling problems of industry today. Write for descriptive literature. *Be Sure With Fluor!*



FLUOR MANUFACTURES MECHANICAL DRAFT COOLING TOWERS

Under certain conditions Fluor can deliver Forced or Induced-type Mechanical Draft Cooling Towers. There must be a willingness on the part of customers to wait while submanufacturers deliver fans, gears and motors to our plant. They can be delivered only on the highest priority. That's why—for the duration—we recommend the Atmospheric type. In the meantime, Fluor continues with research and development of Mechanical Draft types to give you the advantage of many improvements when the war is over.

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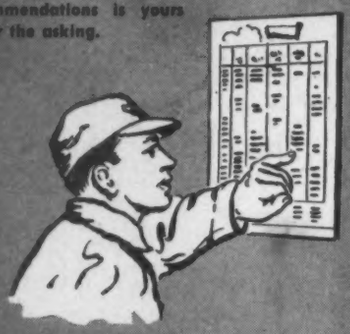
ATMOSPHERIC AERATOR AND MECHANICAL DRAFT COOLING TOWERS

The Palmetto ABC Chart of Packing Service Recommendations is yours for the asking.



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Steam	Mild alkalis
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Air	Gases
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GREENE, TWEED & COMPANY

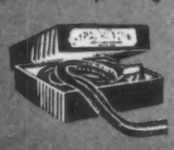
Bronx Blvd. at 238th St., New York, N. Y.

TWISTED

For valve stems; each strand a perfect piece of lubricated packing.

BRAIDED

For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.



PALMETTO

for steam, hot water, air. PALCO for water. PELRO for oils. CUTNO for alkalis. SUPERCUTNO (blue asbestos) for acids. KLERO for foods.

SELF-LUBRICATING PACKINGS

1942 for the high-speed welding of heavy-walled tubing.

Another notable development in the application field was the large increase in the use of alternating-current arc-welding equipment, and particularly its adoption in the shipbuilding field. Its use out-of-doors on subassembly work as well as in ship repair docks gives another strong indication of its almost certain widespread adoption in this field in the future.

There was a significant increase in the use of control equipment on single-operator welders for facilitating the filling of craters as well as for providing increased welding heat at the start of a weld, particularly on thin materials.

The resumption of development work for arc welding in atmospheres of inert gases, such as helium and argon, is particularly noteworthy. The process was commercially applied to the welding of magnesium, aluminum, and the stainless steels.

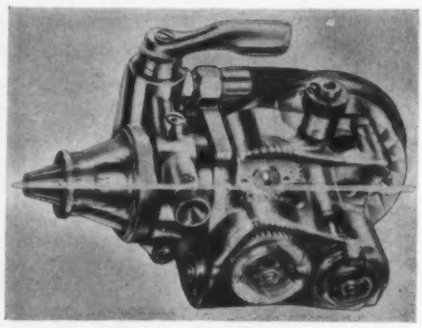
In the electrode field, a long period of intensive development work culminated in the production of a Class E-6011 electrode for alternating-current welding in all positions, particularly the vertical and overhead positions. In conjunction with Class E-6020 electrodes, this electrode provides complete flexibility for the use of alternating-current welding on mild steel, and is therefore a very important contribution to productive efficiency.

Accessories were developed to keep pace with the needs of the industry, the most noteworthy addition being a line of protective clothing for women welders.

Metallizing Gun

METALLIZING COMPANY OF AMERICA

Metallizing Company of America, Chicago, Illinois, has announced the Model P Mogul metallizing gun, built for use with propane, acetylene or generated gases. The unit has been provided with oversize bearings and the entire gear train arranged to run in grease in the new one-piece case. The gun weighs



Phantom view of Model P Mogul Metallizing Gun

only 4½ pounds, and may be used for hand spraying or for fixed-tool-post operation. The Model P may be ordered fitted with special aluminum head instead of the standard type for 11-gauge and ⅛-inch wire nozzles.

Condenser Service Company Moves Headquarters

Condenser Service & Engineering Company has moved its main office to the Seaboard Trust Building, 95 River Street, Hoboken, New Jersey. Two floors of the building have been taken under long term lease.

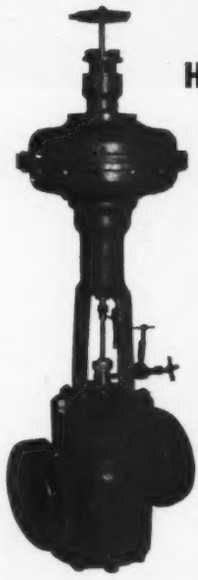
Flame-Proof Blanket

C. WALKER JONES COMPANY

C. Walker Jones Company, East Germantown, Philadelphia, has developed the Jonac fire blanket, an especially knit, flexibie blanket, which is fireproof and introduced for the purpose of extinguishing flames of burning clothing in industrial accidents.

These blankets are available in flameproof containers that may be hung on the wall beside fire-extinguishers, in first-aid stations, or in the equipment provided for air-raid wardens, thus making available effective, on-the-spot protection wherever there is the danger of a workman's clothes being ignited.

H-W Type 86 Motor Valve



With Type H Long Travel Handwheel Control

Features:

Multiple Spring Loaded
•
Upper Stem Roller Guided
•
Fully Reversible Inner Valve Structure
•
Double Stem Connected
•
Special Diaphragm Construction for High Lift Inner Valve Travel
•
Top and Bottom Guided Inner Valves
•
Grease Cartridge Lubricator with Steel Isolating Valve
•
Characterized Parabolic Proportional Flow V-port Inner Valves

1500 pound flanged high pressure Type 86 Motor Valves have heavier sections throughout as well as other changes to insure operation under difficult conditions. Valve stems are heavier. Stuffing boxes are integral with the head plate and are of the bolted flange type. Large packing area, special formed packing with grease rings reduce leakage and friction. These high pressure valves are fabricated with ASA ring joint flanges. Other type facings available upon request.

Available with:

"Forged steel finned sections for packing protection at temperatures above 450° F.

"PG" Purging chambers for protection of packing against action of highly corrosive fluids.

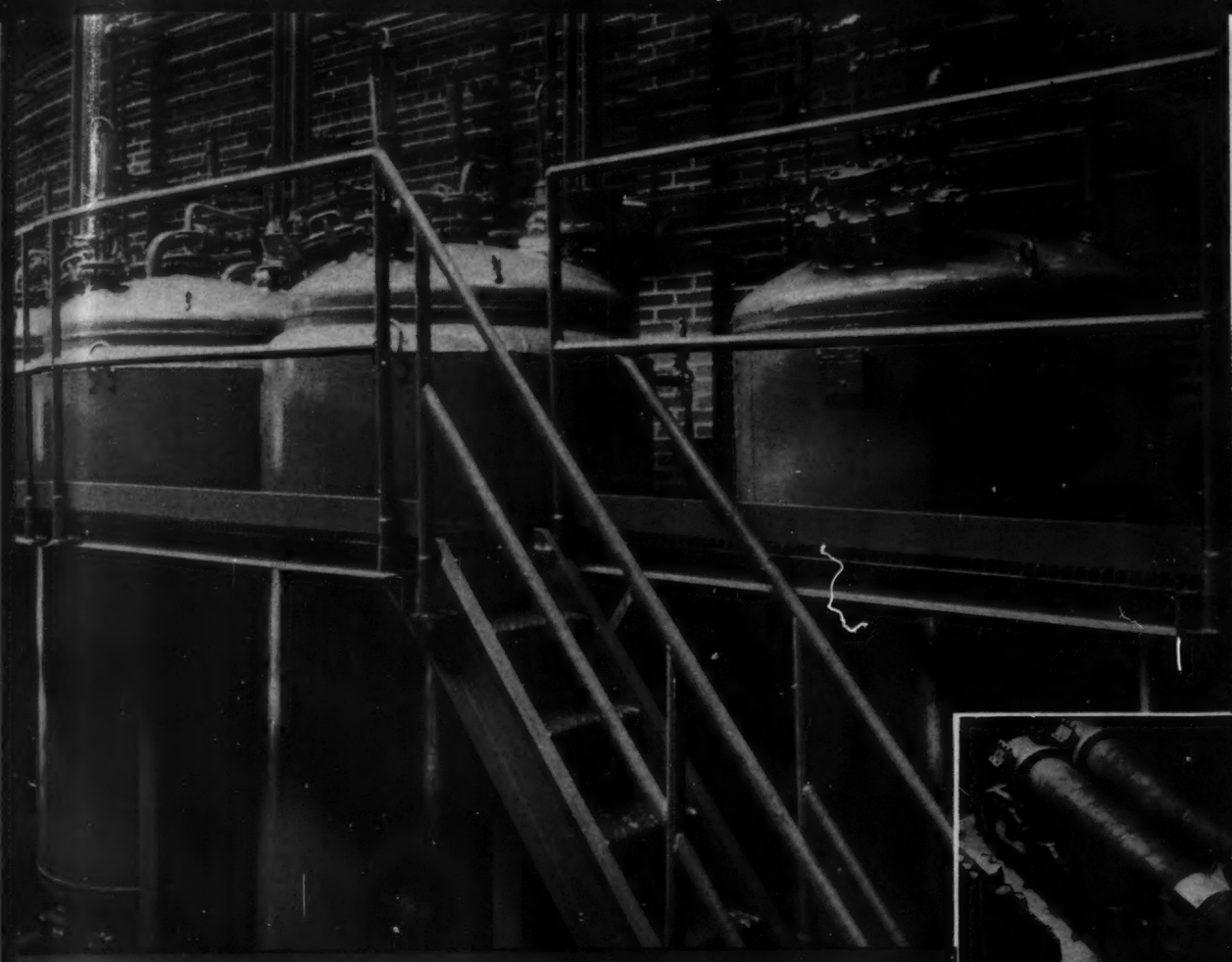
"H" Handwheel control for manual control or setting travel limits of inner valve.

Information on all HANLON-WATERS Equipment available at representative nearest you

HANLON-WATERS, INC.

TULSA, OKLAHOMA

New York, Chicago, Pittsburgh, Philadelphia, St. Louis, Denver, Los Angeles; Shreveport, La.; Fort Worth, Houston, Corpus Christi and Odessa, Texas



Is Acid Corrosion your problem?

IF SO, PFAUDLER GLASS-LINED STEEL EQUIPMENT CAN HELP YOU

STAINLESS STEEL FABRICATION

As one of the country's pioneer fabricators of Stainless Steel, Pfaudler's facilities are complete. Our contributions to the technology of stainless steel welding are a matter of record. Let our certified welders handle your next welding problem. There has never been a failure in a Pfaudler weld.

Among Other Things the Oil Industry Uses Glass-Lined Steel Equipment for:

●

Synthetic Rubber Polymerizers
Removing Mercapatans
Chlorinating Wax
Preparing special catalysts
Butadiene
Experimental, etc.

●

What Is Your Acid Corrosion Problem?

PFAUDLER Glass-Lined Steel Equipment is resistant to all acids (except HF) in any concentration or at any temperature. It stands up where many "tough" alloys have failed.

Special Pfaudler silica base enamels are fused into low carbon steel with a bond or adhesion of approximately 3000 lbs. per square inch minimum. It will withstand temperatures up to 650° F. Internal pressures of 300 lbs. per square inch are possible. Small laboratory units have been built for 500 lbs. pressure.

This equipment is fabricated into many special shapes and designs to meet new operating conditions. This is in addition to a large line of standardized reaction kettles, distillation units, storage tanks, etc. With Pfaudler acid resisting glass-lined pipe, fittings and valves you can process at elevated pressures and temperatures in the complete absence of metal.

Many of the uses of glass-lined steel are especially developed and engineered, so if acid corrosion is your problem our staff will gladly work with you without obligation.

P F A U D L E R

THE PFAUDLER CO., Rochester, New York. Branch Offices: 330 West 42nd St., New York; 1442 Conway Bldg., Chicago; 1405 Howard St., San Francisco; 485 Peel Street, Elgin, St. Louis; 7310 Woodward Ave., Detroit; 931 Little Building, Boston; 1918-1st National Bank Building, Cincinnati; 1339 Commercial Trust Building, Philadelphia.

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But there, in that heat simmered city on the North Coast of Africa, you will find Layne Well Water Systems identical with those in your own city. Built by Layne engineers, these Layne Wells and Pumps have long maintained their unmatched records of high efficiency, long life and consistent dependability.

Whether in Casablanca,—or in any of hundreds of other cities in all parts of the world, Layne Well Water Systems have the quality and ruggedness that keep them going, even under terrific and long sustained overload. Every feature of their design is based upon the highest engineering skill—and then thoroughly proven in prolonged tests under the most rigorous conditions.

In all of the hundreds of installations made for Military and Naval needs in the rush for troop training and war need manufacturing, not one has failed. At present nearly 100 percent of Layne production and service is for war necessity but every effort is being made to repair and keep private and municipal installations in operation.

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Layne-Western Co. of Minn.	Minneapolis, Minn.
International Water Supply, Ltd.	London, Ont.

WORLD'S LARGEST WATER DEVELOPERS

☆ BUSINESS NOTES ☆

Romann Granted Leave For War Research Work

John H. Romann, chief metallurgist of Tube-Turns, Louisville, Kentucky, has been granted leave of absence, following his appointment as chairman of the committee, which will conduct a nation-wide investigation in industry plants concerning the low-temperature properties of metals. This research is being carried out by the War Department and through the war metallurgy committee of the National Research Council, Washington.

J. H. ROMANN

This war metallurgy committee supervises research for several branches of the government. It reports to the office of Scientific Research and Development, an independent agency created by the President.

Dan R. Rankin Promoted By Peerless Pump Division

Dan R. Rankin has been named acting chief engineer of Peerless Pump Division, Fodd Machkery Corporation. He has been with the company for the past five years and has been assistant to the chief engineer.

He is a graduate of the University of California, holding degrees of B. S. and M. S. Many of the innovations in design of Peerless pumps since the start of the war have been made under his supervision.

D. R. RANKIN

Key Company Names District Managers

Two men who formerly represented Key Company, East St. Louis, Illinois, through another organization have been named to district manager posts since the company revised its representation in Tulsa and Houston, January 1, 1943.

J. H. Richardson is the district manager at Houston, where he has offices in the Second National Bank Building.

M. J. Masel is the district manager at Tulsa, where the district office is in the Mayo Building.

J. H. RICHARDSON

M. J. MASEL

The two men formerly were with Koalt Engineering Company, Tulsa, which represented Key Company in the Southwestern territory.

Promotions Announced by Lukens Steel Company

Charles L. Huston, Jr., director of public relations for Lukens Steel Company, Coatesville, Pennsylvania, has been appointed assistant to the president of the company.

John S. Morris has been named methods engineer for By-Products Steel Corporation, a subsidiary of Lukens Steel Company, Coatesville.

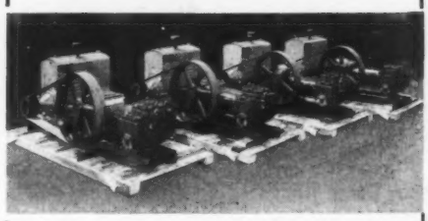
Joshua Hendy Iron Works Buys Pump and Electric Companies

Purchase of Pomona Pump Company, its subsidiary Westco Division, and of Crocker-Wheeler Electric Manufacturing Company, has been completed by the Joshua Hendy Iron Works, Sunnyvale, California. The expansion is part of a program of this company to assure auxiliary facilities for its engine output now going largely into the national shipbuilding program.

C. E. MOORE

Pomona Pump Company and its Westco division, have plants at Po-

HIGH PRESSURE POWER PUMPS



2½ - 4 x 6 Stroke—Pressure - 1000 p.s.i. working, 2000 p.s.i. hydrostatic—Double suction and shaft extension—Roller bearings - herringbone gears—Interchangeable liners—Trim to suit pumping conditions—

Also these designs:

SIMPLEX and DUPLEX
STEAM and POWER DRIVEN
HORIZONTAL and VERTICAL
FORGED STEEL, CAST STEEL
BRONZE and Various ALLOYS
VALVE PLATE, SIDE POT
CLOSE CLEARANCE
BOILER FEED, GENERAL SERVICE
DISCHARGE PRESSURES up to 5000 LBS.
CAPACITIES to 1000 G.P.M.

McGOWAN PUMPS

LEYMAN MANUFACTURING CORP.
The John H. McGowan Co. Division
59 CENTRAL AVE. CINCINNATI, OHIO

Get the top price for your Monel and rolled Nickel scrap

Segregate and avoid contamination

THE U. S. war industry is today in urgent need of Monel and rolled Nickel scrap.

Every pound you turn in is of real and immediate aid. And every such pound of scrap that is not contaminated with other metals, that is free of oil and dirt and properly segregated will return a higher price per pound to you.

When sent with proper authority direct to the Huntington Works of The International Nickel Company, Monel and rolled Nickel scrap is remelted into the form of pig. This is used, by the steel industry, in the making of important alloy steels.

Remember your effort in this scrap drive is not only a fine contribution to victory, it can pay you a substantial cash dividend.

The table and notes at right will help you in the sorting and identification of scrap metals.

QUALITATIVE TESTS FOR IDENTIFYING SOME COMMON WHITE METALS AND ALLOYS

MAGNETIC TEST	NITRIC ACID TEST				
Reaction to Magnet	Reaction to Conc. Acid	Reaction to Acid after Dilution	Color of the Solution	Iron Nail Test for Copper	Material Probably is
Magnetic	Reacts Slowly	Reacts Slowly	Pale Green	No Copper Plates out	Rolled Nickel
Magnetic* (slightly)	Reacts	Reacts Slowly	Greenish Blue	Copper Plates out	Monel
Non-magnetic	Reacts	Reacts	Bluish Green	Copper Plates out	† Copper-Nickel Alloy containing less than 60% Nickel, e.g. Nickel-Silver
Magnetic	Reacts Slowly	Reacts	Brown to Black	Not required	Steel or Cast Iron
Non-magnetic	Reacts Slowly	Reacts	Brown to Black	Not required	Ni-Resist
Magnetic	No Reaction	No Reaction	Colorless	Not required	Straight Chromium Stainless Steel
Non-magnetic	No Reaction	No Reaction	Colorless	Not required	Chromium-Nickel Stainless Steels e.g. "18-8"

*Monel is usually but not always slightly magnetic at atmospheric temperature. Monel that appears to be non-magnetic at atmospheric temperature may become magnetic when cooled by dipping in ice water or in a freezing mixture—other copper-nickel alloys of lower nickel content do not become magnetic. Monel that is magnetic at atmospheric temperature loses its magnetism when heated by dipping in boiling water. This test serves to identify Monel when only a magnet is available—no other common material loses its magnetism in this temperature range.

†"K" Monel is always non-magnetic even when cooled; therefore chemical analysis is required to distinguish "K" Monel from the copper-nickel alloys of lower nickel content.

NOTES ON CARRYING OUT TESTS

1. Magnetic Tests

Bring the magnet in contact with the specimen to be tested. (Be sure that there is no magnetic material such as iron or steel beneath or in the immediate vicinity of the specimen.) The magnet will or will not be attracted to the specimen.

In cases of doubt, and especially where the material appears to be non-magnetic, use a more sensitive testing method:

(a) Balance the magnet or the specimen on the edge of a bench or desk. Then bring the specimen close to the magnet, or vice versa. If the material is magnetic the balance will be upset and a movement of either the magnet or the specimen will be observed.

(b) Another method is to suspend the magnet on a string and bring it close to the specimen. A slight movement of the magnet will be observed if the specimen is even slightly magnetic.

2. Nitric Acid Tests

Clean test surface so that the acid will come into direct contact with the material.

Apply one or two drops of concentrated nitric acid to the clean metal surface.

Let acid remain in contact with the metal for a minute or two.

Observe any reaction that takes place.

Dilute acid by adding three or four drops of water, one drop at a time.

Observe reaction: If solution turns green or blue do not disturb until nail test has been completed.

3. Copper Test with Iron Nail

If nitric acid test forms green or blue colored solution, make test for copper:

Rub a clean iron nail in the colored acid solution on metal surface, keeping nail in contact with the specimen.

If the alloy contains copper, there will be a deposition of copper either on the nail or on the surface of the metal under the acid solution.

Add a drop or two of additional water as the nail is rubbed around to prevent the deposited copper from re-dissolving in the acid.

IMPORTANT!

No Monel and rolled Nickel scrap should be sent to Huntington without authorization.

Authorization must be obtained from the Scrap Salvage Section, Monel and Rolled Nickel Sales Department, The International Nickel Company, Inc., 67 Wall Street, New York, N. Y.

Letters requesting authorization should state:

1. **Kind of metal (Monel or Rolled Nickel)**
2. **The amount**
3. **Type of scrap—turnings, forgings, castings, strip, sheet, etc.**

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street **New York, N. Y.**

THE EXTRA STRENGTH AND CLEANLINESS OF

BATES-GRATES

AT NO EXTRA COST

The clean fillet weld you see on that section of BATES-GRATES gives you a combination of maximum strength and floor safety that makes it very much worthwhile to specify BATES-GRATES for your open steel flooring.

Note the crisp, dirt-and-grease-shedding tread the entire length of the Hex Cross Bar. BATES, alone, gives you that, too.

8½" x 11" BOOKLET GIVES DETAILS. SHOWS MANY INSTALLATIONS

•

WRITE FOR COPY

WALTER BATES COMPANY, INC.

1707 ROWELL AVENUE • JOLIET, ILLINOIS

OPEN STEEL FLOORING • STAIR TREADS

mona, California, and St. Louis. George A. McKenna, president, and the entire executive personnel of the Pomona organization has been retained. In addition to the plants it owned, a new plant at Torrance, California, has been turned over to Pomona Pump Company division of Johsua Hendy Iron Works.

Crocker Wheeler Electric Manufacturing Company, Ampere, New Jersey, will be under the management of A. J. M. Baker, a former associate of Charles E. Moore, owner of Joshua Hendy Iron Works, when the two were assisting in the lend-lease program in Washington.

Arthur B. Guise Joins duGas Corporation

Arthur B. Guise has been elected vice president of duGas Engineering Corporation, Marinette, Wisconsin, and will have charge of development. Formerly he was with United States Rubber Company where he was engaged in fire and safety engineering activities.

A. B. GUISE

Guise, graduated from Massachusetts Institute of Technology as a chemical engineer, spent a number of years in development work in the petroleum industry before joining the Factory Mutual Laboratories where he was employed from 1935 until 1941. In the latter organization he was engaged in the special hazard phases of fire-protection engineering as well as being responsible for the examination and test of first-aid fire extinguishing equipment.

He is a member of the American Petroleum Institute and the National Fire Protection Association. Formerly a member of the committee on Flammable Liquids for N.F.P.A., he is now a member-at-large of the committees on Hazardous Chemicals and Explosives, and Special Extinguishing Equipment.

Industrial Scientific Moves Headquarters

The Houston office of Industrial Scientific, Inc., has moved to new larger quarters at 3205 Harrisburg Boulevard. The new telephone number is Charter 4-6093. Roy O'Neill is manager of the company which carries a complete line of laboratory apparatus and reagent chemicals as well as representing Taylor Instrument Companies on their indicating, recording and controlling temperature, pressure, flow and liquid-level instruments.

Trumbull Is Manager Greene, Tweed & Company

O. W. Trumbull has been appointed vice president and manager of Greene, Tweed & Company, New York. He formerly was with Asbestos Textile Company.

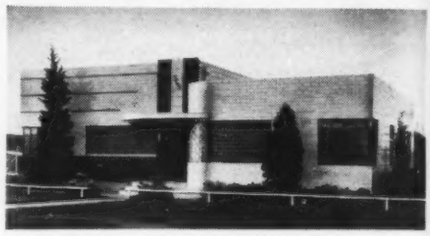
O. W. TRUMBULL

Three American Meter Officials Are Promoted

Norton McKean, who has served as vice president and general manager of American Meter Company, has been elected president. His promotion followed the death of Francis H. Payne.

Vice presidents chosen by the board of directors are John C. Diehl, former chief engineer with headquarters at Erie, and Arthur B. Norton, former manager of the Boston plant. Diehl will serve as

NORTON McKEAN



New Gate and Globe **VALVES**

All New—Special Offering
Must be sold in one lot

24—¾" Series 90 screwed, O S & Y Gate Valves.
24—¾" Series 90 screwed, O S & Y Globe Valves.
50—1" Series 90 flanged, O S & Y Globe Valves.
50—1" Series 90 flanged, O S & Y Gate Valves.
42—1½" Series 90 flanged, O S & Y Gate Valves.
32—2" Series 90 flanged, O S & Y Gate Valves.
61—3" Series 90 flanged, O S & Y Gate Valves.
33—4" Series 90 flanged, O S & Y Gate Valves.

All Standard Dimensions. Approximately $25,000.00 in repair parts furnished with the above valves. Total new value of valves alone $65,000.00.

Will Sacrifice. Wire, Phone or Write

S.I.S.

SONKEN-GALAMBA SUPPLY COMPANY

UNION AVE. AT 21st STREET
TULSA, OKLA.

. . . THIS MAN CAN HELP TO "Keep On Stream!"

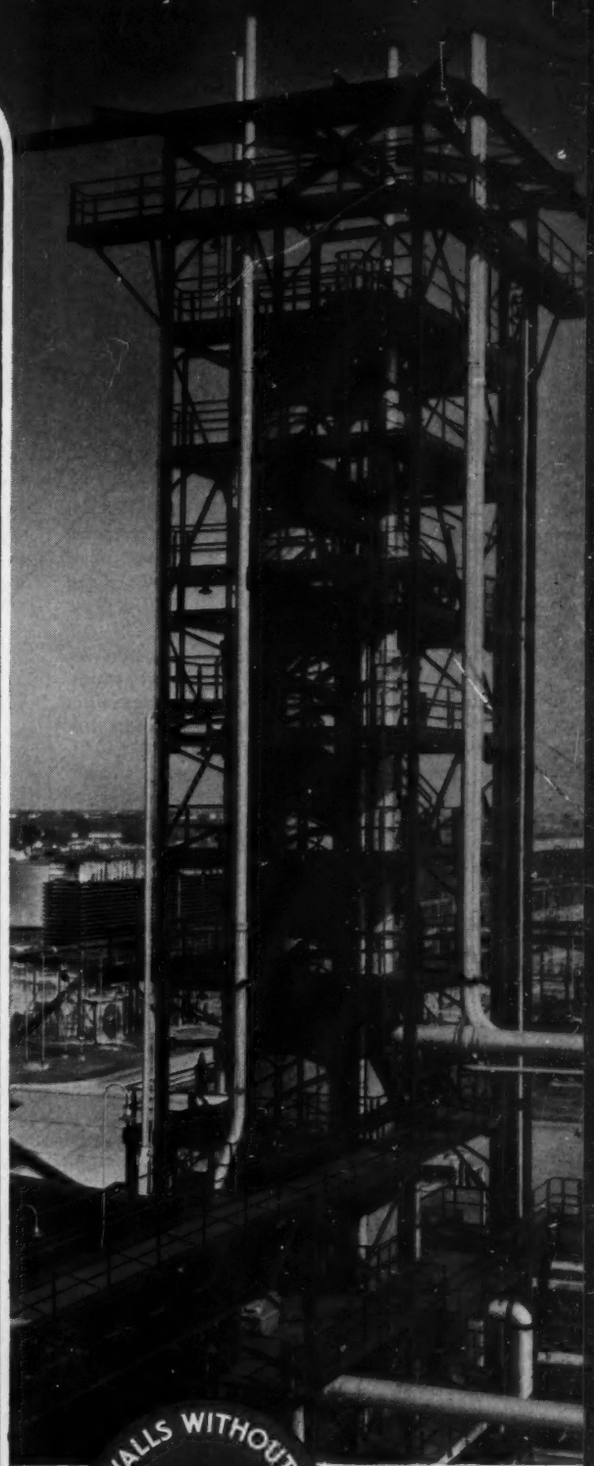
HE'S the tube specialist representing NATIONAL's Complete Tube Service. Today, when you can't always get the exact tubing you've been using, he can be of invaluable service to you.

He knows what various alloys will do in service. He can draw on his experience in recommending an available grade of tubing that will give the best possible service under your conditions.

No one can tell how long this war will last, but long or short, the dominant factor today is increased output. Thus the selection of proper tubes becomes of utmost importance. It is the key to faster operation and greater production.

The most effective program then, is to take advantage of every possible help in selecting the best alloy tubes available to reduce "off stream" time. Any production time wasted now because of less efficient materials used would be a tragedy.

NATIONAL's Tube Specialists know how to help you keep your plants "on stream." Why not take advantage of this service. There's no obligation. We will be glad to cooperate.

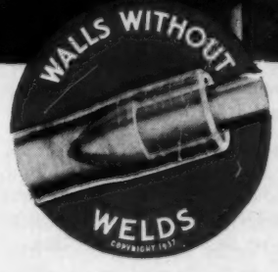


21 ANALYSES TO CHOOSE FROM *

LOW CARBON	2 CR., ½ MOLY., 1¾ SIL.	5 CR., ½ MOLY., COLUMBIUM
LOW CARBON, ½ MOLY.	2¼ CR., 1 MOLY.	7 CR., ½ MOLY.
LOW CARBON, 1 MOLY.	2½ CR., ½ MOLY., ¾ SIL.	8 CR., 1 MOLY.
1¼ CR., ½ MOLY.	3 CR., ½ MOLY., 1¾ SIL.	17 CR.
1¾ CR., ¾ MOLY., ¾ SIL. (Bain Alloy)	3 CR., 1 MOLY.	18-8
2 CR., ½ MOLY.	5 CR., ½ MOLY.	18-8, TITANIUM
	5 CR., ½ MOLY., 1½ SIL.	18-8, COLUMBIUM
	5 CR., ½ MOLY., TITANIUM	

FOR STILL TUBES · CONDENSER TUBES · HEAT-EXCHANGER TUBES · REFINERY PIPING

*During the present emergency the Office of Petroleum Coordinator has recommended to refineries that orders be confined to a limited number of alloy classifications. It will be understood, therefore, that the 21 analyses shown are given as a matter of engineering information, and that some of these alloys may not be available during the period of restrictions.



NATIONAL TUBE COMPANY

PITTSBURGH, PA.

United States Steel Export Company, New York

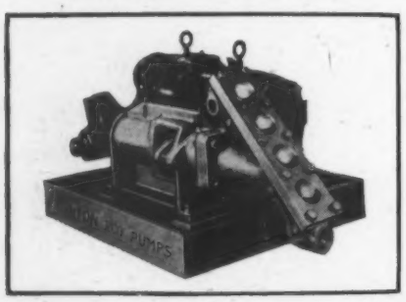
UNITED STATES STEEL

This self-cleaning Milton Roy Step-Valve handles solids in suspension, slurries, sludges, and materials of heavy viscosity with little danger of clogging.

This STEP-VALVE Makes Milton Roy Pumps "Tick"

Note how pumped materials pass through double-ball checks in four distinct steps. These checks act instantly. Each pair open and close practically simultaneously. They seat positively, not only when pumping clear liquids but also in handling slurries, etc. Should the liquid contain solids of sufficient size to prevent a ball from properly seating these would, of course, lodge in the first inlet check. The other checks continue to function as usual. Then the full pressure of the incoming liquid, on the following suction stroke, is exerted against the solid matter and clears the ball and seat. *All Step-Valves are of this same basic design.* Milton Roy Pumps are recommended for handling

OILS • SLUDGES • ASPHALT
SOLVENTS • LATEX
PROCESSING CHEMICALS



and other materials which are extremely difficult or impossible to pump by other means . . . as well as for acids, alkalis, intermediates, fluid greases, etc.

This Step-Valve (patented) is not only self-cleaning and non-clogging, but air-binding is impossible and wire-drawing is eliminated.

Investigate Milton Roy Pumps . . . for refinery services, for use where exact volume control is necessary, for hydrostatic test purposes and high pressure catalysis up to 20,000 lbs. per sq. in. Write for catalog.

We are still making prompt deliveries of most standard units. If we can help in your war production write, 'phone or wire.

MILTON Roy PUMPS
1383 E. MERMAID AVE., CHESTNUT HILL, PHILA., PA.

A. B. NORTON

J. C. DIEHL

manager of the Metric Metal Works plant at Erie.

Other promotions included that of A. McW. Wolfe, former assistant manager, to manager of the Boston plant; Calvin A. Nichols, controller and assistant treasurer, to acting treasurer; Arthur F. Benson, from assistant to chief engineer.

McKean has been with the company since 1913 when he went to work at the Boston plant. His advancements were numerous and he was named manager of the Albany plant in 1928. He has been a director since 1932 and was general manager the following year. He was elected vice president in 1937 and the duties of treasurer were given him the following year.

Diehl has been with the company since 1919, following demobilization of the A. E. F. in which he was a captain. He was in the engineering department for 10 years before becoming chief engineer. He has been a director since 1934.

Norton first came with American Meter Company in 1898 with Nathaniel Tuts Meter Works in Boston. During his long period of service he has been in charge of manufacturing and sales activities in Boston and the New England territory.

Military Awards to Manufacturing Companies

Awards from the Army, the Navy and the Maritime Commission to companies whose products come into the refining industry have been announced during the past month as follows:

Babcock & Wilcox Company, refractories division, Augusta, Georgia, the Army-Navy E, January 22, for outstanding production of refractories.

Dow Chemical Company, Midland, Michigan, two Army-Navy E awards, for production of chemicals "in some instances doubling the designated capacities of your plants."

Foster Wheeler Corporation, Carteret Works, a star, for addition to the Army-Navy E award given six months previous. Also a Minute-Man flag from the Treasury department, "in recognition for exceeding the goal set for purchase of war bonds."

Fluor Corporation Adds Atlantic Coast Office

Fluor Corporation, Los Angeles, has opened a branch in New York in order to provide direct company representation on the Atlantic Seaboard. The office, 1919 R. C. A. Building, is under the management of J. I. Lawrence, formerly in the company's Kansas City office.

This office is staffed for attention to all matters pertaining to the products and services of the company and for

GASKETS

"MELRATH"
"MELOIL"
"MELBESTO"

- **We make gaskets in steel, copper, lead, monel metal stainless steel, Armco iron, aluminum, nickel, fibre, rawhide, rubber or any other material. Plain, corrugated or perforated metal. Metal-asbestos and other combinations; to suit any use—for gasoline, acids, oil, chemicals, alcohols, steam, ammonia, etc. Any size, shape, quantity.**

MELRATH
SUPPLY & GASKET CO., INC.
Tioga & Memphis Sts., Phila., Pa. Est. 1909

Why play blindman's buff?

"Some people waste a whole evening trying to find a 'nice,' 'cheap' place to stay. Not me! I pick out a good hotel and my worries are over. Everything I need is right at my elbow."

J. D. FINDLAY,
Raleigh, N. C.

AMERICAN HOTEL ASSOCIATION
FOR A FRESH START
STOP AT A
HOTEL

Announcing

THE ACQUISITION BY WALLACE COMPANY OF
ROSE-HOSKINS SUPPLY CO., INC.

The new name to be

WALLACE-ROSE-HOSKINS CO.

910 NAGLE STREET ★ P. O. BOX 2095 ★ PHONE CAPITOL 7385 ★ HOUSTON
1365 CROCKETT STREET ★ P. O. BOX 2071 ★ PHONE 5001 ★ BEAUMONT

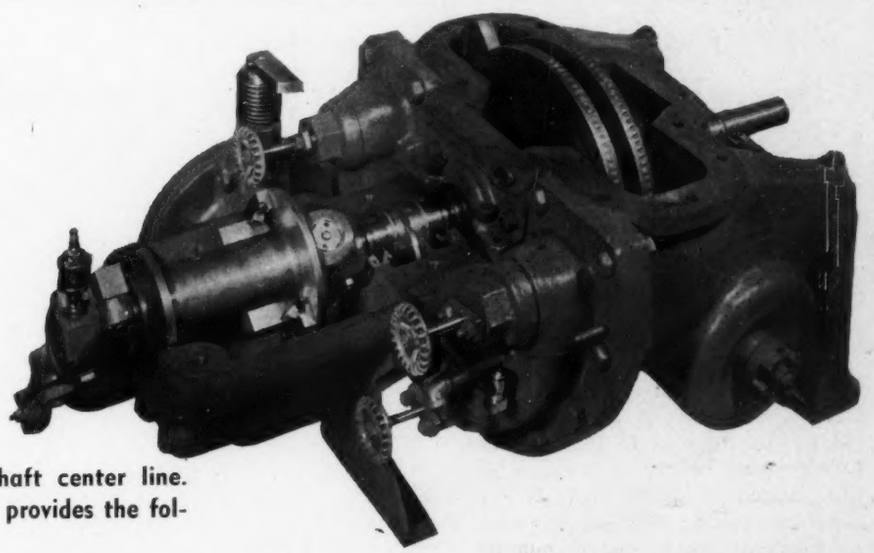
It is our endeavor to maintain
a complete stock in all the lines we handle
We invite your inquiries

C. S. (CHARLIE) WALLACE
OWNER

Youngstown Sheet & Tube Co.—Pipe • Wm. Powell Co.—Valves • Taylor Forge & Pipe Works—F. S. Flanges—Seamless Welding Fittings • Norton Co.—Grinding Wheels • Clayton Mark & Co.—F. S. "Petro," "Hydro," "Mark" Unions • Johns-Manville Corp.—Packing • New York Rubber Corp.—Mech. Rubber Goods • Page Belting Co.—Leather Belting • Stockham Pipe Fittings Co.—C. I. and M. I. Fittings • Bethlehem Steel Co.—Galv. Sheets, Nails and Wire Rope • Republic Steel Corp.—Bar Iron, Angles, Shapes • Henry G. Thompson & Sons Co.—Hand, Power Band Saw Blades • Vulcan Rivet & Bolt Co.—Bolts and Nuts.

MURRAY

Type "U"
Mechanical Drive Turbines



Many of the advantages of the Murray Type "U" Mechanical Drive Turbine are illustrated in the accompanying internal view. The most outstanding feature is the arrangement of the casing, which as shown, is split horizontally well above the shaft center line. This unique and patented construction provides the following desirable features:

1. **Longer steam ring allowing considerably more nozzle area and larger steam inlet size, thereby increasing the maximum horsepower developed by a particular frame.**
2. **Larger exhaust opening which permits of greater horsepower and improved efficiency, particularly for condensing operation.**
3. **Additional hand valves for nozzle control. (Note that view shows three hand valves on our smallest frame, whereas the usual small conventional turbine has room for only one.)**

Other desirable features shown are the stainless steel blading and shroud, center line exhaust end support, flexible steam end support, balanced governor assembly, precision bronze backed babbitt lined bearings, effective bronze labyrinth type oil seals which supplant the older felt type, and separate removable upper carbon packing gland cases.

MURRAY IRON WORKS COMPANY, Burlington, Iowa

How to
SHORTEN DOWN-TIME
of equipment

EQUIPMENT down-time is NON-PRODUCTIVE time. To help you hold this to a minimum, Oakite wartime degreasing materials are specially designed to clean FASTER . . . conserve precious man-hours.

SAVE TIME ON THESE 6 JOBS:

1. Cleaning Heat Exchangers
2. De-Scaling Diesel Engines
3. Cleaning Lube Oil Coolers
4. Salvaging Valves, Fittings, Piping
5. Cleaning Filter Presses
6. Cleaning Absorption Towers

Doing these SIX maintenance jobs the performance-proved Oakite way, as recommended by our nearby Technical Service Representative, will show a surprising saving in time. Let us prove it! Write today for helpful data on ANY CLEANING OPERATION you want performed FASTER, EASIER, BETTER!

OAKITE PRODUCTS, INC.
50B THAMES STREET, NEW YORK, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE MATERIALS · METHODS · SERVICE
Buy Bonds for Victory

direct company-customer contact on matters pertaining to the design, engineering and construction of synthetic rubber, toluene, aviation gasoline, alkylation, isomerization, recycling, natural-gasoline and gas-transmission plants and refineries.

Westinghouse Discontinues Research Fellowships

The Westinghouse Electric and Manufacturing Company has discontinued for the duration of the war the Research Fellowships awarded annually during the past five years to enable leading young scientists to continue their studies at the company's research laboratories in East Pittsburgh. Like the 25 principal manufacturing plants of the Westinghouse Electric and Manufacturing Company, the research laboratories is concentrating on getting the war job done quickly. Pure research, as such, is being pursued only in instances where it helps the war effort.

Mettling to West Coast For Cooper-Bessemer

Phillip W. Mettling, compressor expert of The Cooper-Bessemer Corporation, has been transferred to the branch office, 650 East Sixtieth Street, Los Angeles. For several years he has been in the manufacturing plant at Mount Vernon, Ohio.

At the new location he will continue his work as a compressor calculation engineer. His transfer was for the purpose of giving him closer contact with the field in that important area. His experience with engines will permit him to devote some time to the installation, operation and maintenance of engines.

Mettling is a graduate of Purdue University in mechanical engineering.

Hopkins Promoted By R-S Products

David W. Hopkins has been elected vice president of R-S Products Corporation, Wayne Junction, Philadelphia. He has been secretary and a director of the concern for a number of years. He will continue in charge of the valve division of the concern.

Hopkins is a graduate of the University of Pennsylvania in mechanical engineering and had post graduate work in aeronautical engineering at Massachusetts Institute of Technology. He was a naval aviator in the last war.

New Name Taken By Oil City Concern

Oil City Tank & Boiler Company, Oil City, Pennsylvania, has changed its name to Electroweld Steel Corporation. There have been no changes in management or directors. The product of this widely known boiler company has been discontinued permanently and the entire manufacturing facilities are now devoted to the production of Electroweld tubing. One of the world's most modern electric resistance weld tube mills has been installed. It is now producing invasion tubing for the armed forces at a rate of many miles a day. A new mill, now being built, will increase production.

This company has announced the change of name and its new product in nine leading trade publications. It immediately took an aggressive sales and manufacturing policy to assure successful operations during the peacetime era.

Officials Elected By Beaver Pipe Tools

At a meeting of the board of directors recently, a number of changes were made in the list of top operating officials of Beaver Pipe Tools, Inc., Warren, Ohio.

W. A. Neracher, founder of the company 43 years ago, and president during this entire period, was elected to a newly created position as chairman of the board. W. A. Phillis, formerly vice president, becomes president and general manager; M. W. Bechtel, executive vice president and treasurer; C. W. Shafer, vice president, manufacturing; F. R. Barkley, vice president, sales; and R. C. Mellinger, vice president, accounting.

WANTED—Cracking Plant Metal Inspector
Man with several years refinery experience, preferably in operating or engineering work, to serve as Metal inspector of large Dubbs Cracking Plant and other refinery equipment. General Engineering Department work when not engaged in Inspection duties. Medium sized independent Oil Company located in Middle West. Reply Box 550, c/o Petroleum Refiner, Houston, Texas, stating experience, education, and salary desired.

POSITION WANTED—Refinery overseer of operations and Chemist, 15 years experience, wishes to make connection with company building or planning to build new refinery. Can direct construction of and equip laboratory, plan pipe lines and expedite production of products at minimum expense and maximum efficiency. Address Box 28, c/o Petroleum Refiner, Houston, Texas.

FOR SALE—Two 250 hp. boilers, two stage air compressors, 75 kw. a.c. generator, ammonia condensers, receivers, pumps, hoists, motors, absorbers, generators, valves and fittings. Complete Dead Weight Gauge Tester, Watt Hour Meter, 125 Volt, 150 Amp. Must dismantle at once. Capital Ice Refrigerating Co., Indianapolis, Ind.

WANTED
ASPHALT TECHNOLOGIST
Position requires man with technical degree who has had five years experience in the manufacture and blending of roofing and paving asphalts. Location, middle West with medium sized oil company. Our employees know of this advertisement.
Box 450, c/o Petroleum Refiner
Houston, Texas

QUICK REPAIRS ON
CONDENSERS
and
HEAT EXCHANGERS

If you need condenser or heat exchanger repairs **in a hurry** call us. We specialize in fast, high quality work.

25 Years Successful Experience

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"Service, Not Promises"
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